

RESEARCH AND THE
BASIC CURRICULUM

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A BRIEF GUIDE
TO THE FINDINGS OF RESEARCH IN
THEIR RELEVANCE TO THE TEACHING
OF THE BASIC SUBJECTS

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PREFACE

THE word "research" as here used does not describe any specific method or procedure. It designates a point of view—an attitude of enquiry and of willingness to test any theory against the evidence of the most carefully scrutinised and representative body of available facts. It implies a readiness to give up preconceived notions and to seek guidance not only from traditional interpretations but also from direct observation and experiment in any field of study. When successful, such research adds to the sum of human knowledge, and wise use of its findings leads to the husbanding of resources and the discovery of more satisfactory ways of living.

The last fifty years in the educational world have been characterised by an increasing readiness to apply the methods of research to the solution of educational problems—to base policy upon the results of investigation and to seek information about actual conditions and needs both in the schools and in the adult community.

The last fifty years have also been noteworthy for distinctive changes in methods of teaching, in curricula, in type of building, in equipment, and in the attitude of pupils to teachers and of teachers to pupils. While these changes are paralleled by alterations in the outlook of the community, in its aims, its prosperity, and its increasing acceptance of responsibility for individual welfare and safety, there is some reason to believe that the direction they have taken in the schools is chiefly attributable to the consequences of the gradual application to education of the findings of experimental investigation.

In the pages which follow no attempt is made to summarise all the studies which have contributed to these modifications. It is possible, however, to trace through the decades certain lines of development, a knowledge of which is both stimulating to a teacher and informative to the prospective research worker. An endeavour will be made to sketch these in broad outline, to indicate the main sources of information available, and to suggest directions in which further investigation

promises to provide as powerful an incitement to educational reform as has the experimental research of the last fifty years.

Certain portions of the following chapters appeared in abbreviated form in the *Journal of Education*, and the author has pleasure in expressing thanks to the Editor for permission to make use of them here.

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CHAPTER I

THE BACKGROUND

AN understanding of present practice in educational research can best be achieved through some consideration of its history and some awareness of the remarkable recency of its origin.¹ Fifty years ago many procedures which are now familiar were quite unknown; and much current discussion would have been unintelligible to teachers skilled in the methods of the eighteen-nineties.

In the latter part of the nineteenth century the aim of popular education was primarily the conquest of illiteracy. This was to be achieved by formal exercising of the intellectual faculties. The chief pupil-activity was learning by heart, and the principal pupil-virtues were silence, orderliness, and conformity to rule. It was assumed that children were indifferent or hostile to learning, and that successful teachers should rule their kingdoms as monarchs whose will was law. Curricula were narrow and limited to formal studies; and buildings consisted of large lecture-halls with equipment for little except corporate response.

Against such conditions there had been protests from thinkers like Pestalozzi, Froebel, and Herbart. Their theorising prepared the way for the changes which afterwards came; but their ideas made little progress, since they suffered from a lack of supporting evidence and remained at the level of mere opinion.

It was left to psychologists² to justify the acceptance of a new conception of learning on the basis of the findings of contemporary biology; and through their influence the prestige of the scientific movement in other fields became a powerful instrument of propaganda for new methods and for better conditions in the schools.

¹ For a history of its organised development in Britain see: Rusk, R. R., *Research in Education: An Introduction*. London: University of London Press Ltd. 1932. See also: Clarke, F., *The Study of Education in England*. London: Oxford University Press. 1943.

² Cf. James, W., *Principles of Psychology*. London: Macmillan & Company. 1890.

This new interpretation of the nature of learning represented education as an active, complex process and the learner as an organism that developed by reacting and adjusting itself to concrete situations—perceiving, weighing alternatives, and discriminating. The task of the teacher was no longer so commonly thought to be the mere administering of instruction. Pupils were encouraged to take part in meeting situations of a type similar to those which they might encounter in later experience. They were to “learn by doing” and the responsibility of the school was enlarged to include the provision of suitable social and environmental opportunities. It was discovered that (given such opportunities) children were eager to learn and that teachers need no longer cultivate the mannerisms of a despot.

Arguments in favour of these newer conceptions were based on generalisations drawn from the findings of experimental study in various fields. Prominent among the earliest of these was the work of William James, Thorndike, Woodworth, and Winch on the problem¹ of the transfer of training. Proof seemed given that learning was largely specific in its effect, and it was concluded that the activities of pupils should be socially useful—for their childish needs and their adult life. Following upon this came research on the content of the curriculum, upon subject-matter and upon text-books. Analytic studies of the learning activities of animals led to laboratory studies of children, and these in turn were followed by the founding of psychological clinics and educational clinics for the treatment of problem pupils.

School surveys of performance in the basic subjects were followed by group testing of intelligence, and this by a clearer recognition of individual differences. Studies in clinical psychology drew attention to the importance of the total environment and prepared the way for some understanding of the part played by pupils’ physical, emotional, and social experiences.

It is not always realised that most of this ground was covered in the first two decades of this century. The pro-

¹ For a recent summary see: Hamley, H. R., *The Cognitive Aspects of Transfer of Training*, in Report of the Consultative Committee on Secondary Education. H.M.S.O. 1938. Earlier work is exemplified in: Sleight, W. G., *Educational Values and Methods*. Oxford: At the Clarendon Press. 1915.

tests of McDougall and of Freud against the excessively intellectual emphasis of the philosophers attained their clearest expression in the first decade. Dewey wrote upon interest and Thorndike reviewed evidence on individual differences. Binet and Simon applied the principle of age-performance to the construction of mental tests. Spearman formulated an interpretation of test inter-relationship which prepared the way for present methods of factorial analysis. Stanley Hall stimulated the study of child-development and Thorndike perfected his explanation of learning as the formation of connections. In the same years Wertheimer was busy with the experiments in visual perception which led to his alternative interpretation in terms of "gestalt" or pattern.

The second decade saw the Great War, with its encouragement to group testing, its introduction of trade tests for munition workers, its attempts to rate the personal attributes of recruits and its aftermath of problem children whose needs led to the beginnings of the scientific treatment of behaviour-disorders and learning disabilities.

Educational clinics were already well established in America by the opening of the third decade, and their findings led to fuller realisation of the necessity for better adaptation of schools to the needs of their pupils. Adjusting to individual differences resulted in proposals such as the Dalton Plan and the Winnetka Technique; and the interest in society which followed the study of problem pupils (combined with a connectionist belief in the specificity of learning) led to the popularising of a method of teaching through projects or real-life activities. Researches were initiated to determine the social uses of the curriculum and proposals to break down subject-barriers found support in a new educational sociology.

The latter part of the third decade saw a consolidation of earlier studies of the part played by inheritance and by environment; and some progress was made in the scientific investigation of differences of character and disposition. Group tests of attitudes and values began to absorb as much attention as group tests of intelligence and achievement; and more highly elaborated methods of statistical analysis were applied to the study of aptitude for differing types of further education.

The fourth decade was a period of criticism. The production of new tests was retarded by economic distress; and attention was directed to discussions of test reliability and validity, of age-allowances for competitive examinations, of the degree of constancy of the intelligence quotient, and of the necessity for more careful control of experimentation. Efforts were made to evaluate what had been accomplished, and plans were formulated for studies of large groups of children over long periods of years as well as for highly elaborated case-studies of individuals.

Reports upon this more critical work are only now reaching publication; but already there is evidence which seems to show that many tests are highly specific; that there is much variability in the growth of individuals, and that a profound influence is exerted by a person's interests, ambitions, and wishes upon his present performance—whether that be in school, in workshop, or in factory. More stress is consequently being laid upon the effect of membership of groups. Less is being said of the social usefulness of instruction and more attention is being given to social and emotional maturity and the desirability of the satisfaction of human needs through co-operative activity. Emphasis is also being put on the value of educational guidance, of exploration of the whole personality in its social setting, and there is less acceptance of the predictive certainty of the results of individual aptitude testing.

There are, in other directions also, signs of greater awareness of the effects of variations in "social climate"; and there is a greater belief in educability than was possible in the first decade of the century when philosophic fiction dealing with the characteristics of human beings was as yet largely unchallenged by the evidence obtainable from measured observation and experiment.

This brief reminder of the background of educational research in the last six decades may serve to illuminate the summaries which follow.

No apology is made for the use of terminology which describes types of learning and teaching under headings such as reading, arithmetic, and the like. The employment of these terms carries, in itself, no pronouncement as to methods of teaching. It is a mere adult convenience which offers a

means of classifying the types of activity which are basic to any curriculum.

A brief list of references is appended. These are selected because of their importance as key-books, each of which is representative of work conceived and executed during the years immediately prior to its date of publication. Together they serve as some indication of the chronological order of the topics chosen.

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CHAPTER II

READING

READING was one of the first school subjects to be studied experimentally, and it is probably the subject in which the most obvious changes have been wrought by the findings of research. To understand the direction and extent of these changes it is only necessary to recall conditions as they were in schools forty or fifty years ago.

NINETEENTH-CENTURY AIMS AND TEXT-BOOKS

The aim of a teacher of reading was then very simple. The purpose of instruction was the cultivation of ability to read aloud in an audible, articulate fashion, and the most subtle distinctions entering into its criticism were those between enunciation and pronunciation, between "intelligence," phrasing, emphasis, and fluency.¹

The printed material used in nineteenth-century reading lessons was correspondingly unstudied and subjected to relatively little analysis. In structure and phrasing it was based on adult models, and text-books were small, closely printed volumes of instructive stories or descriptions which were intended to "improve the minds" of the pupils. The contents of these stories varied from time to time according as the emphasis of the moment was on religion, virtue, patriotism, science, culture, or utility; but in essence they were the same—adult in content and improving in aim.²

NINETEENTH-CENTURY METHODS

Methods of teaching were of comparable simplicity. The faculty theory, with its assumption of the similarity of all

¹ Cf. Garlick, A. H., *A New Manual of Method*. London: Longmans, Green & Co., Ltd. 1896. See also: Wyld, H. C., *The Teaching of Reading in Training Colleges*. London: John Murray. 1908.

² Cf. Smith, N. B., *Successive Emphases in American Reading Instruction*. Teachers' College Record 34. New York: Columbia University. December 1932.

minds, provided some justification for mass teaching; and when popular education expanded, mass methods were adopted because of their relative cheapness in personnel and equipment. The minds of children were thought of as weaker and smaller replicas of the minds of adults; and faculties such as memory, reasoning, or imagination were held to require "exercise" and "discipline." It mattered little whether such discipline was accepted willingly or unwillingly. A competent teacher could therefore organise work for one hundred pupils as readily as for fifty. Pupils' minds were "passive" (like blank sheets of wax ready to receive impressions), and, since all were essentially alike, it was as easy to impress a large class as a small. Reading lessons were conducted on class lines. One pupil (or the teacher) read aloud. The others watched on their own copies of the same book. Every eye was believed to move at the same rate. Every mind (if attention was maintained) was expected to be impressed in the same way by the observations of the teacher, and every pupil who was not deliberately "lazy" was thought to be exercised to the same degree in response to the teacher's questions on the content of each sentence or the meaning of each word.

Such class teaching gave a gratifying sense of power to teachers, and they learned the tricks of manner by which superficial attentiveness could be achieved. The theory behind it provided a rational justification for the use of the physical punishment or verbal cruelty which were required to drive pupils through the meaningless drudgery of reading the same small text-book over and over again. "Exercise" of reading ability was the aim. Co-operation, interest, and activity on the part of the pupils were not thought of as necessary factors in achieving swift and pleasurable competence in reading.

NINETEENTH-CENTURY EXPERIMENTS

The beginnings of scientific observation of the reading process may be traced to work in the laboratories of Valentius, Cattell, Erdmann, Javal, and Ahrens in the middle of the nineteenth century. These investigators were occupied with the study of visual perception, and their attention was concentrated on the extent of visual span, the type, direction, and

speed of eye-movement, and the effect of meaningful material on all of these.¹

Most of their work was carried out under laboratory conditions, and it necessitated the use of somewhat elaborate tachistoscopic and photographic apparatus. It had little immediate effect upon the complacent efficiency of the schoolrooms; but it was valuable in that it called attention to some of the differences between oral reading and silent reading, and in that it revealed something of the unrealised complexity of the reading process.²

FIRST STEPS TOWARDS A NEW OUTLOOK

In the same decades, however, a breach in the assumption that all pupils could move at an equal pace was made by the failure of even the most "successful" teachers to bring every pupil at a given age to a given "standard." "Payment by results" was a reasonable sequel to implicit faith in the possibilities of mass teaching. When teachers were forced after bitter experiment to protest against its injustice a step had been taken towards modifying methods in the light of the findings of objective evidence. Many years were to pass before the implications of that protest were realised.

Another step towards a more enlightened procedure was taken in the early years of the twentieth century when psychologists both in Europe and in America were invited to measure the products of the class-room. The "standards" of the old days of "payments by results" had been subjectively determined in accordance with the theory that the minds of all children (if adequately exercised) were essentially the same at any given age. Such *a priori* knowledge of the content of children's minds was repudiated by the psychologists. Instead

¹ Useful summaries of the findings of these early experiments are given in: Dearborn, W. F., *The Psychology of Reading*. New York: Science Press. 1906. Huey, E. B., *The Psychology and Pedagogy of Reading*. New York: The Macmillan Company. 1908. Schmidt, W. A., *An Experimental Study in the Psychology of Reading*. Chicago: University of Chicago. 1917. Gray, C. T., *Deficiencies in Reading Ability*. New York: D. C. Heath & Co. 1922. Vernon, M. D., *The Experimental Study of Reading*. London: Cambridge University Press. 1931.

² Cf. Rusk, R. R., *Introduction to Experimental Education*. London: Longmans, Green & Co., Ltd. 1912.

of venturing on generalisations as to the contents of pupils' minds they declared that before formulating a standard for children of a certain age, they must first test the children and discover the level which could be reached by a certain percentage at that age. They emphasised the need for impartiality and objectivity of test material and they pleaded for the necessity of recognising differences in initial ability, in rate of learning, and in power of retentiveness.¹

EARLY READING TESTS

Standardised tests constructed on these lines were devised for school surveys in Britain and America; and among the tests for this purpose, the earliest standardised reading tests appeared.² Typical of the simplicity of these are Starch's comprehension tests, which consisted of short passages to be read silently for thirty seconds. After exactly half a minute, a mark had to be made to indicate the last word read, and then all that could be remembered of the passage had to be written. Success was estimated by counting the number of words read per second and the number of written words which correctly reproduced the thought.

RESULTS OF TESTING

The results of this early testing revealed to administrators an unexpected range of individual differences and a very wide overlapping of performance from year to year or class to class. This was at first attributed to the inefficiency of the teacher (as had been the failure to bring each pupil up to the "standard" of "payment by results"); but it was soon found that the phenomenon was so widespread that some other explanation must be sought.

The challenge of this realisation of the extent of differences was met in two ways.

¹ See: Binet, A., *Les Idées Modernes sur les Enfants*, Paris, 1910, for an excellent account of his pioneering work in this direction. His scales of performance in school subjects have attained less fame than his tests of intelligence, but they are probably of equal importance in the history of achievement testing.

² For specimens of the earlier tests see: Starch, D., *Educational Measurements*. New York: The Macmillan Company. 1916. A valuable summary of the development of tests of achievement as well as of intelligence is given in Hamley, H. R., *The Testing of Intelligence*. London: Evans Brothers Ltd. 1935.

(1) It led to a more careful analysis of what was involved in the process of reading and of what was required in a test before it could provide full evidence of the difficulties which pupils were encountering.

(2) It raised questions as to whether the existing organisation of teaching on class lines was meeting the needs of pupils whose differences were now for the first time objectively revealed. In this apparently simple fashion two movements began—that towards scientific educational diagnosis and that towards individualised instruction and adjustment of the school organisation to the needs of the pupils. Contemporary with these movements and providing their theoretical justification, there have been further changes in the psychology of learning; and these have been followed by a new emphasis on the importance of the past history of the pupils, their attitudes, activity, and interest, and also by a new realisation of the importance of pupils' co-operation, insight, and sense of responsibility for their own learning.¹

ANALYSIS OF THE READING PROCESS

Careful analysis of what was involved in the process of reading was at first carried out in psychological laboratories attached to University Education Departments. It was influenced by the earlier work which had been done on visual perception in the nineteenth century, but it was more consciously directed to removing the difficulties of pupils who had fallen behind their contemporaries. It was now remedial rather than observational in aim.² (From its success in isolated cases came the interest in diagnosis and treatment which led to the establishment of educational clinics, and later to the opening of child-guidance clinics which attempted

¹ For discussions of differing interpretations of the learning process see: Bode, H. B., *Conflicting Psychologies of Learning*. Boston: D. C. Heath & Co. 1929; Henry, Nelson B., *The Psychology of Learning*. Forty-first Yearbook of the National Society for the Study of Education. Part II. Bloomington, Illinois: Public School Publishing Company. 1942; Hilgard, E. R., *Theories of Learning*. New York: D. Appleton-Century-Crofts Inc. 1948.

² See: Fernald, G. M., and Keller, H., "The Effect of Kinaesthetic Factors in the Development of Word-Recognition in the Case of Non-Readers." *Journal of Educational Research*, IV, pp. 354-77. 1921. Hincks, E. M., *Disability in Reading and its Relation to Personality*. Cambridge: Harvard University Press. 1926.

to extend diagnosis beyond educational difficulties to difficulties in behaviour and abnormalities of character. Methods which proved successful in such clinics are now finding their way back to the schools through experimentation with classes of backward pupils; and marked economy of effort with increased efficiency is resulting.¹)

Typical of the careful analysis and specificity of prescription characteristic of the decade is the following list² of common difficulties and suitable methods of treatment.

In this same decade, from about 1915 to 1925, methods of testing became more detailed. Attempts were made to

<i>Symptoms.</i>	<i>Useful Methods of Treatment.</i>
Mispronunciation. Confusion of somewhat similar consonants or vowels.	Speech training. Lists of similar words given (a) orally, (b) visually. Practice in recognising letters heard and seen. Training in analysis of words.
Reversals.	Emphasis on direction of reading by exercises involving tracing, finger pointing, or underlining while reading.
Repetitions.	Training in methods of attacking new words. Encouragement of calmness and slower rate. Reading aloud along with the pupils.
Substitutions of guessed words.	Word games in which phonic analysis is emphasised. Use of easier material. Enlargement of vocabulary by activities of various kinds.

¹ See: Kennedy-Fraser, D., *The Education of the Backward Child*. London: University of London Press Ltd. 1932. Brueckner, L. J., et al., *Educational Diagnosis*. Thirty-fourth Yearbook of the National Society for the Study of Education. Bloomington, Illinois: Public School Publishing Company. 1935. Hamley, H. R., *The Education of Backward Children*. London: Evans Brothers Ltd. 1936. Burt, C., *The Backward Child*. London: University of London Press Ltd. 1937. Schonell, F. J., *Backwardness in the Basic Subjects*. Edinburgh: Oliver & Boyd Ltd. 1942.

² See also: *Report of the National Committee on Reading*. Twenty-fourth Yearbook of the National Society for the Study of Education. Part I, Chapter X. Bloomington, Illinois: Public School Publishing Company. 1925.

<i>Symptoms.</i>	<i>Useful Methods of Treatment.</i>
Additions or omissions of words.	Emphasis on meaning. Flash cards with incomplete sentences and complete ones for comparison. Reading in concert with the teacher.
Omission of lines.	The use of wide line spacing. Underlining while reading. Reduction of anxiety and strain.
Frequent pauses and hesitations.	Enlargement of vocabulary. Practice with flash cards showing unfamiliar words. Use of easier material.
Jerky reading—word by word.	Reduced emphasis on words. Training with flash cards showing phrases or sentences to which responses are to be made to indicate understanding of meaning.
Lack of intelligent interpretation.	Use of easier material. Emphasis on meaning. Provision of a motive for reading. Practice with sentence flash cards.
Excessive vocalisation.	Increased training in silent reading. Discouragement of lip movement. Practice with flash cards to enlarge vocabulary and to develop correct eye movements.
Difficulty in recall.	Practice in summarising. Use of easier materials.
Inability to read quickly.	Practice in skimming to locate a word or a phrase in a paragraph or a sentence on a page (<i>a</i>) orally, (<i>b</i>) in writing.
Difficulty in noting details in a description.	Use of completion exercises. Underlining of correct answers. Construction of questions on given paragraphs. Extension of spoken vocabulary to secure greater familiarity with words. Use of easier material.

measure knowledge of letters and words, ability to follow directions, and comprehension of sentences or short paragraphs.¹ Through the use of such tests, interest in reading difficulties was further stimulated and realisation of individual differences became more widespread.

CRITICISM OF MASS TEACHING

The movement towards individualised instruction produced in consequence a relatively rapid impression on the schools. Many varieties of schemes were devised to secure a more fluid organisation which should "break the lock-step" of the assumed possibility of equal advance for every pupil every day. Adams, Dewey, and Washburne did much to popularise the modifications suggested²; and the acceptance of the Dalton Plan in certain schools in Britain made progress possible through the publication of individual assignments to supplement existing text-books.

The chief results of these pioneering endeavours were:

- (1) a realisation of the need to teach pupils how to study,
- (2) a critical analysis of the content of the curriculum and the content of the materials in use as reading text-books.

TEACHING PUPILS TO STUDY

If instruction is to be individualised, pupils must be given responsibility and encouraged to engage in independent study. (The Dalton Plan made a valuable contribution towards this by its attempt to make each pupil organise his own work.) It was, however, soon realised that it was necessary to do more than merely tell pupils to "study." They had to be trained

¹ Cf. Burt, C., *Mental and Scholastic Tests*. London: P. S. King & Son Ltd. 1921. Ballard, P. B., *The New Examiner*. London: Hodder & Stoughton Ltd. 1923.

² Cf. *Adapting the Schools to Individual Differences*. Twenty-fourth Yearbook of the National Society for the Study of Education. Part II. Bloomington, Illinois: Public School Publishing Company. 1925. Parkhurst, H., *Education on the Dalton Plan*. London: G. Bell & Sons Ltd. 1922. Dewey, E., *The Dalton Laboratory Plan*. London: J. M. Dent & Sons Ltd. 1924. Adams, J., *Modern Developments in Educational Practice*. London: University of London Press Ltd. 1922. Irwin, E. A., and Marks, L. A., *Fitting the School to the Child*. New York: The Macmillan Company. 1924. Washburne, C., Vogel, M., and Gray, W. S., *Results of Fitting Schools to Individuals*. Bloomington: Public School Publishing Company. 1926.

in the art of studying.¹ Analysis of this art led teachers back to the question as to what was involved in silent reading and through the practical necessity for improved methods an opening was made for practice in silent reading in the class-room.²

The products of silent study next required to be tested. Mere summarising or reproduction of what had been read was both tiresome to undertake and difficult to mark. Attention was therefore directed to the possibilities of formulating questions whose answers would be definite and easily marked; and the devices of sentence completion, single-word answers, and underlining, which had been developed in standardised intelligence tests, were applied to analytic reading tests.³

¹ Cf. Book, W. F., *Learning how to Study and Work Effectively*. Boston: Ginn & Company. 1926. Earlier discussions are given in: Whipple, G. M., *How to Study Effectively*. Bloomington, Illinois: Public School Publishing Company. 1916. Starch, D., *Educational Psychology*. New York: The Macmillan Company. 1919.

² Cf. Gray, W. S., *The Relation of Silent Reading to Economy in Education*. Sixteenth Yearbook of the National Society for the Study of Education. Part I, pp. 17-32. Bloomington, Illinois: Public School Publishing Company. 1917. *Report of the Society's Committee on Silent Reading*. Twentieth Yearbook of the National Society for the Study of Education. Part II. Bloomington, Illinois: Public School Publishing Company. 1921. O'Brien, J. A., *Silent Reading*. New York: The Macmillan Company. 1921. Judd, C. H., and Buswell, G. T., *Silent Reading: A Study of the Various Types*. Supplementary Education Monograph, No. 23. Chicago: University of Chicago, Department of Education. 1922. Pennell, M. E., and Cusack, A. M., *How to Teach Reading*. New York: Houghton Mifflin Company. 1924. Watkins, E., *How to Teach Silent Reading to Beginners*. Philadelphia: J. B. Lippincott & Company. 1924. *Report of the National Committee on Reading*. Twenty-fourth Yearbook of the National Society for the Study of Education. Part I. Bloomington, Illinois: Public School Publishing Company. 1925. Gray, W. S., *Summary of Investigations Relating to Reading*. Chicago, Illinois: The University of Chicago. 1925. Streitz, R., *Teachers' Difficulties in Reading and their Correctives*. University of Illinois Bulletin, No. 23. Urbana, Illinois: Bureau of Educational Research, College of Education. 1925. Herriott, M. E., *How to Make a Course of Study in Reading*. University of Illinois Bulletin, Educational Research Circular, No. 42. Urbana, Illinois: Bureau of Educational Research, College of Education. 1926. Stone, C. R., *Silent and Oral Reading*. Boston: Houghton Mifflin Company. 1926.

³ English examples of these are found in: Burt, C., *Northumberland Standardised Tests, II, English*. London: University of London Press Ltd. 1925. See also: *Report of the National Committee on Reading*. Twenty-fourth Yearbook of the National Society for the Study of Education. Part I, Chapter IX. Bloomington, Illinois: Public School Publishing Company. 1925. A recent popular summary may be found in Ballard, P. B., *Teaching and Testing English*. London: University of London Press Ltd. 1939.

NEW TEXT-BOOKS AND CURRICULUM ANALYSIS

A further step was taken when it was realised that such devices could be incorporated in the reading-books which pupils were to use in school. A new type of Aided Study Reader was devised to include simple testing and directions for study along with extracts for reading. Interest in these led rapidly to the question as to whether such books were exactly suited to the age of the reader. Analysis was made of their contents; and investigations were begun into the reading which pupils did out of school.¹ An attempt was next made to apply the principle of age-performance to the type of story included in the curriculum at each stage, and later to the vocabulary and sentence structure of school reading-books. It was realised that the choice of such details should be determined not by adult preferences nor with the aim of improving the minds of the pupils, but that they should correspond to what was found to be actually interesting and understandable by a large percentage of children at any given age.²

¹ Cf. Jordan, A. M., *Children's Interests in Reading*. London: Humphrey Milford, Oxford University Press. 1926. Washburne, C., and Vogel, M., *What Children like to Read: Winnetka Graded Book List*. New York: Rand, McNally & Company. 1926. Terman, L. M., and Lima, M., *Children's Reading*. New York: D. Appleton-Century Company. 1931. See also: Jenkinson, A. J., *What do Boys and Girls Read?* London: Methuen & Co., Ltd. 1940.

² Cf. Gates, A. I., *Interest and Ability in Reading*. New York: The Macmillan Company. 1930. Uhl, W. L., *The Materials of Reading, Their Selection and Organisation*. Newark: Silver, Burdett & Company. 1924. Wilkinson, M. S., Weedon, V., and Washburne, C., *The Right Book for the Right Child*. New York: John Day Company. 1933. Dunn, F. W. (Chairman), *Materials of Instruction*. New York: Bureau of Publications, Teachers' College, Columbia University. 1935. Hatfield, W. W. (Chairman), *An Experience Curriculum in English*—a report of the Curriculum Commission of the National Council of Teachers of English. New York: D. Appleton-Century Company. 1935. Norton, J. K., and Norton, M. A., *Foundations of Curriculum Building*. Boston: Ginn & Company. 1936. Huber, M. B., Bruner, H. B., and Curry, C. M., *Children's Interests in Poetry*. Chicago: Rand, McNally & Company. 1927. Bamberger, F. E., *The Effect of the Physical Make-up of a Book upon Children's Selection*. Baltimore: Johns Hopkins University Studies in Education. 1922. Gray, W. S., *Report of the National Committee on Reading*. Twenty-fourth Yearbook of the National Society for the Study of Education. Part I, Chapter VII. Bloomington, Illinois: Public School Publishing Company. 1925. *The Teaching of Reading: A Second Report*. Thirty-sixth Yearbook of the National Society for the Study of Education. Part I, Chapters VII and VIII. Bloomington, Illinois: Public School Publishing Company. 1937. See also: Luckiesh, M. and Moss, F. M.,

Well-organised schools began to use reading tests as part of their routine, and in some cases they permitted differentiation of text-books according to the reading age of the pupil as revealed by the tests. It was no longer considered satisfactory to spend ten to sixteen months in "exercising" reading ability on one text-book. Supplementary readers were utilised, and twelve to fifteen books were often studied in place of one. Exclusive emphasis on oral reading was admitted to be both uneconomical and harmful. Differences of rate and eye movement were recognised in the two processes of silent and oral reading; and it was realised that differences of requirements on the part of different pupils destroyed the validity of the assumption that forty-nine pupils obtained maximum benefit by merely watching the words which were read aloud by the fiftieth pupil or by the teacher.

CLASS-ROOM REORGANISATION

Reorganisation took two main forms: (a) grouping of pupils for silent reading and for oral reading; (b) attention by the teacher to the oral reading of one pupil while the remainder of the class carried out some form of silent reading exercise.¹ In both cases more attention was inevitably given to diagnosis of the needs of individual pupils, and the findings of class-room experimentation and clinical study of backward pupils became of much greater importance to teachers. The present position of such researches may be summarised as follows:

THE FINDINGS OF CLINICAL STUDY AND RESEARCH

Learning to read is a complex process. A more practical realisation of the multiplicity of the factors which are asso-

Reading as a Visual Task. London: Chapman & Hall Ltd. 1942. Gray, W. S., *Reading in Relation to Experience and Language*. Chicago: University of Chicago. 1944. Arrowsmith, G., et al., *Reading: An Educational Approach*. London: Evans Brothers Ltd. 1947. Carmichael, L. and Dearborn, W. F., *Reading and Visual Fatigue*. London: George G. Harrap & Co. Ltd. 1948. Russell, D. H., *Children Learn to Read*, Boston: Ginn & Company. 1949. Eames, T. H., *Visual and Related Factors in Reading*. Review of Educational Research. XIX, 2. April 1949. pp. 107-17.

¹ Cf. Fleming, C. M., *Individual Work in Primary Schools*. London: George G. Harrap & Co., Ltd. 1934.

ciated with its mastery was perhaps the most characteristic development of the years between about 1926 and 1936. Comparable with the increasing emphasis placed upon this is the importance still attached to the recognition of individual differences, to diagnosis of disabilities, and to specific remedial treatment through suitably adapted methods and materials.

SILENT READING

Some degree of efficiency in silent reading is essential before one can read aloud at sight with fluency and expressiveness. Rates of reading vary with (*a*) the kind of material, (*b*) its difficulty, (*c*) its purpose, and (*d*) the conditions under which reading is done. They vary also from individual to individual according to the facility with which ideas are apprehended. Silent reading is utilised in later life more frequently than oral reading, and therefore training in silent reading and in the art of studying is a necessary part of the task of the school.

ORAL READING

At the same time oral reading is a valuable means of speech development, and it provides a useful method of testing extent of vocabulary and efficiency in pronunciation.¹ It can be exercised in occasional socialised periods and in individual practice with the teacher as audience and critic. There is no excuse for retaining the old-fashioned type of class reading lesson; but due provision for oral work can be made without emotional upset to the unskilful reader and without the unnecessary boredom of an unwilling audience of unoccupied pupils. A well-balanced reading programme includes experience in both types of activity; and there is evidence that even in the initial stages a combination of the methods of oral reading and silent reading is more efficient than exclusive emphasis on either activity alone. Non-oral methods of beginning reading tend to conceal pupils' difficulties in word recognition and pupils' errors in eye movement. Methods which exclude silent reading are likely to establish habits of

¹ Cf. Case, I. M. W., and Barrows, S. T., *Speech Drills for Children in the Form of Play*. Boston: The Expression Company. 1929. Parrish, W. M., *Reading Aloud: A Technique in the Interpretation of Literature*. London: Thomas Nelson & Sons Ltd. 1932.

vocalisation which later interfere with speed and comprehension. From the infant-room stage upwards into the junior school, silent reading and oral reading are most successfully organised round simple class-room projects or activities,¹ and at later ages much practice can profitably be incidental to enquiries in geography, history, nature study, or arithmetic.²

DIAGNOSTIC TESTING AND CASE-STUDIES

There is need for diagnostic testing³ to discover:

- (a) the degree of reading-readiness of the pupils,
- (b) the specific nature of the difficulties of each individual.

After the tests have been given it is necessary to utilise their results by thorough case-studies of pupils who are found to be in difficulties.

¹ Cf. Storm, G. E., and Smith, N. B., *Reading Activities in the Primary Grades*. Boston: Ginn & Company. 1930; and Gardner, D. E. M., *Testing Results in the Infant School*. London: Methuen & Co., Ltd. 1942. See also: Dottrens, R., and Margairaz, E., *L'Apprentissage de la Lecture par la Méthode Globale*. Neuchatel: Delachaux et Niestlé S.A. 1941. McCulloch, C. M., Strang, R. M., and Traxler, A. E., *Problems in the Improvement of Reading*. New York: McGraw-Hill Book Company, Inc. 1946. Gray, W. S., *On Their Own in Reading*. Chicago: Scott Foresman and Company. 1948. Gates, A. I., et al., *Reading in the Elementary School*. The Forty-eighth Yearbook of the National Society for the Study of Education, Part II. Chicago: The University of Chicago Press. 1949. De Witt Boney, C., et al., *Children Learn to Read*. National Council of Teachers of English. 1949. Russell, D. H., *Children Learn to Read*. Boston: Ginn & Company. 1949.

² For suggestive material see: *Report of the National Committee on Reading*. Twenty-fourth Yearbook of the National Society for the Study of Education. Part I, Chapter V. Bloomington, Illinois: Public School Publishing Company. 1925. *The Teaching of Reading: A Second Report*. Thirty-sixth Yearbook of the National Society for the Study of Education. Part I, Chapter V. Bloomington, Illinois: Public School Publishing Company. 1937. See also: McCallister, J. M., *Purposeful Reading in College*. New York: D. Appleton-Century Company Incorporated. 1942. Gates, A. I., et al., *Reading in the Elementary School*. The Forty-eighth Yearbook of the National Society for the Study of Education. Part II. Chicago: The University of Chicago Press. 1949. Gray, W. S., et al., *Reading in the High School and College*. The Forty-seventh Yearbook of the National Society for the Study of Education. Part II. Chicago: The University of Chicago Press. 1948. Witty, P., *Reading in Modern Education*. Boston: D. C. Heath & Company. 1949. Russell, D. H., *Children Learn to Read*. Boston: Ginn & Company. 1949. Kinney, L., and Dresden, K., *Better Learning through Current Materials*. California: Stanford University Press. 1949.

³ For an accessible account of diagnostic tests see Schonell, F. J., in Hamley, H. R., *The Testing of Intelligence*. Chapter VIII. London: Evans Brothers Ltd. 1935.

DIAGNOSTIC TESTING

Characteristic of the increasing recognition of the complexity of the reading process which distinguishes the researches of these years is the production of batteries of tests in place of the survey tests of the years 1915 to 1925.¹ Gates' tests, for example, measure rate and accuracy in

- (1) reading to get the general significance of a passage,
- (2) reading to anticipate the outcome of given events,
- (3) reading to understand precise directions,
- (4) reading to note significant details.

For each of these abilities there is a page or two of test material which utilises all the accepted devices of standardised testing, and in addition to these Gates offers graded tests of word-pronunciation and word-recognition.² Comparable in complexity are the Sangren-Woody Reading Tests³ (which measure word-meaning, rate, fact material, total meaning, central thought, following directions, organisation) and the Iowa Silent Reading Tests. The latter are for senior pupils, and utilise material from social science, literature, and science to provide measurement for:

- (1) paragraph comprehension,
- (2) comprehension of word-meanings,
- (3) comprehension of single sentences in various contexts,

¹ In Britain the nearest approach to these as yet is the Northumberland Standardised Test series of 1925 (C. Burt. London: University of London Press Ltd.). More recent tests which provide forms for a useful range of four or five years are of the survey type of comprehension test with extracts of increasing difficulty, e.g. Fleming, C. M., *Kelvin Measurement of Reading Ability*. Glasgow: Robert Gibson & Sons Ltd. 1932. Fleming, C. M., *Cotswold Measurements of Ability in English*. Glasgow: Robert Gibson & Sons Ltd. 1946 and 1950; of the word-recognition type, e.g. Vernon, P. E., *The Standardisation of a Graded Word Reading Test*. London: University of London Press Ltd. 1938; or of the type which utilises one long paragraph whose comprehension is to be indicated by answering questions or filling in blanks in a completion form, e.g. *The Brighton Reading Tests*. London: University of London Press Ltd. 1931. See also tests in Schonell, F. J., *Backwardness in the Basic Subjects*. Edinburgh: Oliver & Boyd Ltd. 1942.

² Cf. Gates, A. I., *The Improvement of Reading*. New York: The Macmillan Company. 1927.

³ Sangren, P. V., and Woody, C., *Sangren-Woody Reading Test*. New York: World Book Company. 1927.

- (4) ability to organise and rearrange,
- (5) ability to use an index and to alphabetise lists of words,
- (6) rate and comprehension in reading a long passage.¹

Such tests make detailed diagnosis much more possible than it was twenty years ago; but they need to be supplemented by careful observation of pupils in the act of reading, and by analysis of errors as well as by investigations into the habits and activities of pupils out of school. As a result of such studies it will be found that a pupil's technical skill at any level is influenced by his physical, mental, social, and emotional maturity.

READING-READINESS

Reading-readiness was formerly discussed only in relation to the question as to when pupils were ready to begin the process of learning to read.²

Some evidence has been obtained which points to a mental age of six and a half as a suitable level at which to commence instruction; but it is possible that with different methods and materials different results might be obtained. It is probable that the optimum age can best be ascertained from observation of the times at which reading proves most satisfactory to the individual as well as most socially useful.

"Reading-readiness," however, is a term which may usefully be applied to the successive stages of development through which individuals pass before they acquire mature reading habits. Progress is often arrested at a relatively low level, and there is need for study of a pupil's progress in the primary school³ as well as in the infant school,

¹ Cf. Greene, H. A., and Jorgensen, A. N., *Iowa Silent Reading Tests*. Iowa City: University of Iowa. 1927. *The Dominion Tests*. Group Test of Reading. Kindergarten and Grade I. Toronto: University of Toronto. 1949. *Dominion Achievement Tests in Silent Reading*. New Norms. 1949.

² For a useful summary of such discussions see Harris, A. J., *How to Increase Reading Ability*. London: Longmans, Green & Co., Ltd. 1940. De Witt Boney, C., et al., *Children Learn to Read*. National Council of Teachers of English. 1949. Russell, D. H., *Children Learn to Read*. Boston: Ginn & Company. 1949.

³ Cf. Monroe, M., *Children who cannot Read*. Chicago: University of Chicago Press. 1932. McKee, P., *Reading and Literature in the Elementary School*. Boston: Houghton Mifflin Company. 1934. Gray, W. S., *On Their Own in Reading*. Chicago: Scott Foresman & Company. 1948. De Witt Boney, C., et al., *Children Learn to Read*. National Council of Teachers of English. 1949. Gates, A. I., et al., *Reading in the Elementary School*. The Forty-eighth Yearbook of the

in the secondary school¹ as well as among adult learners.²

At the initial stages, the factors that influence readiness for beginning reading have been classified under three main headings:

- (1) intellectual development, including mental age, ability to remember word forms, and ability to do abstract thinking,
- (2) physical development, including adequate general health, vision, and hearing,
- (3) personal development, including emotional stability and the desirable habits and attitudes needed for adjustment to conditions in school.³

The same three categories are useful when we consider learning at any stage; and, while to some extent adequate

National Society for the Study of Education. Part II. Chicago: University of Chicago Press. 1949. Russell, D. H., *Children Learn to Read*. Boston: Ginn & Company. 1949. See also: *Studies in Reading*, Vol. II. Scottish Council for Research in Education, XXXIV. London: University of London Press Ltd. 1950.

¹ Cf. McCallister, J. M., *Remedial and Corrective Instruction in Reading*. New York: D. Appleton-Century Company. 1936. Wheeling, K. E., and Hilson, J. A., *Audio-Visual Materials for Junior and Senior High School Reading*. New York: The H. W. Wilson Company. 1941. "Improving Reading Instruction in the Secondary School." *Bulletin of the California State Department of Education*, XVI, 1. May 1947. Blair, G. M., *Diagnostic and Remedial Teaching in Secondary Schools*. New York: The MacMillan Company. 1947. Gray, W. S., et al., *Reading in the High School and College*. The Forty-seventh Yearbook of the National Society for the Study of Education. Part II. Chicago: University of Chicago Press. 1948.

² Cf. Gray, W. S., and Leary, B. E., *What makes a Book Readable?* Chicago: University of Chicago Press. 1935. Norris, K. E., *The Three R's and the Adult Worker*. Montreal: McGill University. 1940. McCallister, J. M., *Purposeful Reading in College*. New York: D. Appleton-Century Company. 1942. Buswell, G. T., *How Adults Read*. Chicago: University of Chicago Press. 1937. Accounts of experimentation relevant to this may be found in: Richards, I. A., *Practical Criticism: A Study of Literary Judgment*. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1929. Ballard, P. B., *Thought and Language*. London: University of London Press Ltd. 1934. Carmichael, L., and Dearborn, W. F., *Reading and Visual Fatigue*. London: George G. Harrap & Co., Ltd. 1948. Gray, W. S., et al., *Reading in the High School and College*. The Forty-seventh Yearbook of the National Society for the Study of Education. Part II. Chicago: University of Chicago Press. 1948.

³ Cf. Harrison, M. L., *Reading Readiness*. Boston: Houghton Mifflin Company. 1936. Smith, N. B., et al., *Readiness for Reading and Related Language Arts*. The National Council of Teachers of English. 1950. See also: Watts, A. F., *The Language and Mental Development of Children*. London: George G. Harrap & Co., Ltd. 1944.

development in any of these directions is a matter of growth and maturity, it is also influenced by experience and environmental conditions. At each stage, therefore, it is necessary to ask whether pupils have a wide background of knowledge, sufficient facility in the use of ideas, an adequate speaking vocabulary, some accuracy of pronunciation and competence in visual and auditory discrimination. There must in addition be sufficient interest on the part of the pupil to ensure sustained effort, a certain degree of emotional balance, and adequate opportunities for the exercise of the degree of ability attained. All these conditions are to some extent under the control of an enthusiastic teacher, and well-directed experiences have been proved to effect improvement in every one of them.

READING DISABILITIES

The factors accompanying reading disabilities are comparable in diversity to the factors which are diagnostic of reading-readiness. They are of sufficient importance to warrant a brief classification of those which occur most frequently.¹

PERCEPTUAL DIFFICULTIES IN READING

(a) *Visual Difficulties*

Poor vision may need correction by glasses, and bad habits of approach may require to be eliminated. Defective peripheral vision may reduce the visual span so that pupils read very slowly, lose the place, or miss lines altogether. Difficulty in recognising the orientation of forms may lead to delay in the elimination of reversals, and pupils may require practice on very simple material with emphasis (through tracing or

¹ Cf. Monroe, M., *Children who cannot Read*. Chicago: University of Chicago Press. 1932. Brueckner, L. J., et al., *Educational Diagnosis*. Thirty-fourth Yearbook of the National Society for the Study of Education. Chapter XII. Bloomington, Illinois: Public School Publishing Company. 1935. Gann, E., *Reading Difficulty and Personality Organization*. New York: King's Crown Press. 1945. Robinson, H. M., *Why Pupils Fail in Reading*. Chicago: University of Chicago Press. 1946. McCulloch, C. M., Strang, R. M., and Traxler, A. E., *Problems in the Improvement of Reading*. New York: McGraw-Hill Book Company, Inc. 1946. Witty, P., *Reading in Modern Education*. Boston: D. C. Heath & Company. 1949. Russell, D. H., *Children Learn to Read*. Boston: Ginn & Company. 1949.

finger pointing) on the direction in which reading should be done.¹

(b) *Auditory Difficulties*

It has been estimated that about forty-two per cent. of poor readers² have difficulty in sound discrimination and sound memory, and that about fifty-two per cent. are more or less unsuccessful in sound blending. Partial deafness, faulty articulation, and limited knowledge of words account for a certain proportion of these cases.

MOTOR DIFFICULTIES IN READING

Defective motor control reduces ability to move the eyes rhythmically and accurately. It is also closely associated with speech defects, such as poor articulation, stammering, or stuttering, and is in many cases a sequel to birth injuries, nervous diseases, or glandular imbalance. Recognition by the teacher of the origin of such disabilities renders their handling more sympathetic and increases the likelihood of successful treatment.

INTELLECTUAL DIFFICULTIES IN READING

Dull children require simplified material suited to their mental age. They also need to be studied so that undesirable attitudes and a sense of failure do not develop as a result of premature attempts to force reading upon them. Poor readers, as a group, are not markedly distinguished for inferior intelligence. They do, however, often require training in inferential thinking, in the use of complex sentences and a somewhat wide range of words, and in ability to reproduce accurately what they have heard. Linguistic difficulties are often not easy to differentiate from difficulties that are more strictly intellectual in origin.

¹ See also: Orton, S. T., *Reading, Writing and Speech Problems in Children*. London: Chapman & Hall Ltd. 1937. Macmeeken, M., *Ocular Dominance in Relation to Developmental Aphasia*. London: University of London Press Ltd. 1939.

² Monroe, M., loc. cit. See also: Rossignol, L. J., *The Relationships Among Hearing Acuity, Speech Production, and Reading Performance in Grades 1A, 1B and 2A*. New York: Teachers' College, Columbia University. 1948.

EMOTIONAL DIFFICULTIES IN READING

Emotional maladjustment is observable in almost every case of reading disability. In some instances reactions appear which may be interpreted as sequelæ to failure in reading. Examples of this type are aggressive dislike of reading, resistance to teaching, withdrawal from reading, apathy, obvious discouragement, or compensatory mechanisms such as unusual talkativeness or mild forms of delinquency. In other cases emotional maladjustment seems to be a primary cause of the reading difficulty. Over-protected children may be unwilling to take the step towards maturity involved in learning to read independently. Spoilt children may be unable to adjust themselves to the orderly routine of school life, and children who suffer from unwise parental ambition or unhappy rivalry with older brothers or sisters may accept the position that they are "word-blind" or "cannot read."¹ In all such cases help is needed both by children and parents before harmonious emotional adjustment can be achieved.

A lesser degree of difficulty is sometimes observed in association with differences in the speed of learning on the part of different pupils. Hildreth,² for example, describing the daily experiences of a child in word-recognition, reports that words of a pleasant emotional tone were learnt with much more ease than words representing things feared or hated, or words describing situations over which deep-seated emotional complexes might have developed.

Whether the effect of emotional upset be great or small, all recent evidence points to the importance of establishing an atmosphere of happy, confident security in the homes or the school-rooms in which progress towards reading maturity is

¹ Cf. Fleming, C. M., *Individual Work in Primary Schools*. Chapter XVII. London: George G. Harrap & Co., Ltd. 1934. Blanchard, P., "Reading Disabilities in Relation to Difficulties of Personality and Emotional Development." *Mental Hygiene*, 20. July 1936, pp. 384-413. See also Monroe, M., and Backus, B., *Remedial Reading*. London: George G. Harrap & Co., Ltd. 1937. Gann, E., *Reading Difficulty and Personality Organization*. New York: King's Crown Press. 1945. Robinson, H. M., *Why Pupils Fail in Reading*. Chicago: University of Chicago Press. 1946. Witty, P., *Reading in Modern Education*. Boston: D. C. Heath & Company, 1949.

² Hildreth, G., "An Individual Study in Word Recognition." *Elementary School Journal*, 35. April 1935, pp. 606-19.

to be made. Encouragement is one of the first needs of the child who has met defeat, and confident expectation of success is one of the best means of eliminating failure. Such success can be won for every pupil by careful diagnosis, wise adaptation of materials and methods, and intelligent kindness on the part of parents and teacher.

METHODOLOGICAL FACTORS IN READING DIFFICULTIES

Poor methods of instruction and over-emphasis on some particular type of skill may retard progress. A generation ago too much stress was put on oral reading, and pupils were often unable to report intelligently upon material which they could read fluently at sight. Nowadays, in some quarters, there is a tendency to neglect oral reading; and pupils' difficulties in word-discrimination may escape notice. Too much attention to speed may destroy understanding and induce unhealthy nervous anxiety. Excessive interest in developing a wide vocabulary may reduce accuracy of recognition and prevent the repetition which is necessary before a real knowledge of meanings can be established. Material that is too difficult may lead to discouragement and confusion, and the provision of insufficient material may destroy interest and zeal. Too much time devoted to recreational reading, to self-aided study, or to remedial treatment may each retard the development of well-balanced reading skill.

In most cases of difficulty the disability is not traceable to one of these causes alone. The pupil usually suffers from a combination of handicaps against any one of which he might have made a successful stand. Such complexity of causes makes diagnosis exceedingly difficult, and renders some knowledge of the art of case-study an essential part of the equipment of every teacher.¹

¹ An interesting analysis of the frequency of various contributory factors is given by Witty, P. A., and Kopel, D., "Causes of Poor Reading and Remedial Technique." *Illinois Teacher*, 24. September 1935. (Cited in *Review of Educational Research*, VII, 5, p. 504. December 1937.) Lack of interest: 84 per cent; meagre background of experience: 82 per cent; incorrect placement in school: 80 per cent; inability to sustain attention: 40 per cent; emotional instability: 36 per cent; circumscribed interests in recreational life: 34 per cent; excessive oral reading at initial stages: 20 per cent; frequent change of school: 18 per cent; defective vision or hearing: 12 per cent; illness or poor physical condition: 12 per cent; change of left- to right-handedness: 4 per cent.

CASE-STUDIES

The multiplicity of factors which contribute to reading disability necessitates the inclusion in each case-study of preliminary enquiries as to the developmental or medical history of the pupil. Any information as to normality of growth in infancy and childhood is useful. Questions may be asked as to birth injuries, age of learning to walk or talk, speech defects, and type of handedness. The occurrence of neurological illness such as chorea or infantile paralysis may be significant. Debility, eye or ear trouble, and throat infections may have been the cause of prolonged absences from school, which in turn have reacted on a pupil's progress. Malnutrition, fatigue, or lack of sleep may have deprived him of the energy necessary for learning. The attitudes of his companions and his relatives towards his problem may have destroyed the courage which is essential for progress.

A physical examination of the backward pupil can next be undertaken and every possible correction made of his general health or his visual, auditory, and motor handicaps. A psychological examination is also necessary. This should usually consist of six sections:

- (i) *Tests of intelligence.*
- (ii) *Achievement tests.*
- (iii) *Tests of attitude and assessment of personality.*

Wherever possible these should include tests of arithmetic and spelling, as well as word-recognition, oral reading, and silent reading.¹ It is valuable to know whether scholastic

¹ Such tests are most useful for comparative purposes when they are standardised on one pupil-population and by one investigator. Useful early British sets are given in Burt, C., *Mental and Scholastic Tests*. London: P. S. King & Son Ltd. 1921; and Ballard, P. B., *Mental Tests*. London: Hodder & Stoughton Ltd. 1920. When it is desirable to compare a pupil's performance with that of the class from which he comes, survey group tests may also be used, such as the Kelvin Measurement of Spelling Ability, the Kelvin Measurement of Ability in Arithmetic, and the Kelvin Measurement of Reading Ability. Glasgow: Robert Gibson & Sons Ltd. 1932-4 (see: Fleming, C. M., *A Survey of Reading Ability*. Unpublished Ph.D. thesis. Glasgow University Library and Library of the Scottish Council for Research in Education. Edinburgh, 1930); and the Schonell Tests, 1936-42 (see: Schonell, F. J., *Backwardness in the Basic Subjects*. Edinburgh: Oliver & Boyd Ltd. 1942). For pupils at the stage of entrance to the Secondary school useful series are: Thomson, G. H., *Moray House Tests*. London: University of London Press Ltd. Fleming, C. M., *Cotswold Tests*. Glasgow: Robert Gibson & Sons Ltd.

retardation is occurring in reading alone or in other school subjects as well.

(iv) *Analysis of Reading Errors*

This should involve a record not merely of mistakes, but of attitude, manner of approach, posture, and rate of work.

(v) *Tests of Various Factors related to Reading*

Visual discrimination and memory, auditory acuity and memory, motor skill, handedness, eye preferences, eye movements should all be estimated as accurately as possible.¹

Notes should also be made as to the spoken vocabulary and the type of sentence used in ordinary conversation. These may provide useful indications of the pupil's personal interests and pursuits, and may give clues to the type of reading material that might prove interesting and suitable.

(vi) *Estimates of Temperament and Character*

Pupils may be apathetic, excitable, inattentive, discouraged, suspicious, jealous, or diffident. They may lack nervous stability, confidence, and poise. They may suffer from unwise handling out of school, or they may believe teachers to be hostile or indifferent. In every case progress can only be made when the child is restored to some measure of normal and happy adjustment to life at home and at school. All the wisdom and skill of the teacher or the psychological expert is often needed before such readjustment can be effected.

REMEDIAL METHODS

Remedial methods are in essence the same as the methods adopted in successful teaching of so-called normal pupils. They differ only in that they are applied with greater flexibility and more discrimination; and there is reason to believe that, where adaptation to individual differences is combined with wise appraisal of the progress of pupils at each stage of learning, remedial or corrective instruction becomes to a large extent unnecessary.

Various methods of teaching the beginnings of reading have been found helpful; but the most recent findings

¹ For typical tests of these see Whipple, G. M., *Manual of Mental and Physical Tests*. Baltimore: Warwick & York Inc. 1910.

indicate that phonic, kinaesthetic, visual, or alphabetic approaches have often to be combined and modified according to the interests and abilities of the pupils. While from eight to fifteen per cent. of the school population¹ suffers from some form of reading disability, there is no standard treatment for all cases.

For most pupils some training in phonics and word analysis is helpful, but children can learn to read without phonic experience, and phonics should not be introduced until the pupil has a sight vocabulary of fifty to a hundred words, has established the habit of reading for meaning, and has begun to notice similarities in word structure.

Remedial work, by its very nature, includes training in word knowledge through spoken English, the use of flash cards containing unfamiliar words, phrases, or sentences (according to the type of difficulty which the pupil is experiencing), practice in rapid location and recognition of words or phrases in pages of printed matter, training in the use of dictionaries and books of reference, exercises in analysis of sentences or paragraphs with emphasis on meaning rather than on mechanics, encouragement to speed, and training in the keeping of individual progress charts. The will to learn to read can be developed by providing material which answers questions which pupils are ready to ask, and a change of method is often in itself a stimulus to effort and a means of release from the inhibitions consequent on repeated failure with a method previously experienced.

Remedial attention is most helpful when it is given individually, and realisation of the need for this is one of the chief present-day arguments in favour of greater flexibility in methods of instruction. Remedial tuition is best given when the pupil is not fatigued, and it should never carry with it the association of punishment or separation from fellow-pupils. Practice for brief periods at intervals of a day or two is more effective than longer periods at intervals of a week or more. Treatment should be definite in aim and adapted to the level of the learner. Generous praise should be given and

¹ Cf. Betts, E. A., *The Prevention and Correction of Reading Difficulties*. New York: Row, Peterson & Company. 1936. McCallister, J. M., *Remedial and Corrective Instruction in Reading*. New York: D. Appleton-Century Co., Inc. 1936.

learning should take place in an atmosphere of happy confidence.

Pupils with special abilities and defects are usually best taught by methods which utilise their special ability, and only after confidence has been re-established should attempts be made to supply corrective material to deal with their defect. Children with speech defects, for example, should learn to read by methods which emphasise silent response to meanings. Pupils who are deficient in motor control should learn through visual or oral rather than through kinaesthetic or tracing methods. Pupils who have some manual dexterity should have opportunities of using their skill in script writing or in tracing,¹ and pupils with poor hearing should come to reading through a visual approach rather than through an auditory one.²

The task of the teacher is to recognise the existence of such individual difficulties and to provide a sympathetic atmosphere in which these difficulties are admitted and dealt with in a friendly and unemotional fashion.

WELL-CONSTRUCTED TEXT-BOOKS

It is also within his province to see that the teaching material he uses is constructed on scientific lines. Studies of extent of vocabulary and word-counts to determine frequency of use are no longer of merely academic interest. It has for some years been realised that the teaching of English as a foreign tongue is facilitated by the limitation of a pupil's initial experience to a selected vocabulary,³ and the importance of a corresponding curtailment of the number of words to be attempted by English children at each stage is now beginning to be recognised.

It is important, of course, to ensure that words for such lists be selected on the basis of their usefulness as well as their

¹ Recent attempts have been made, with some success to help such pupils through the use of a typewriter. Cf. Haefner, R. W., "The Influence of the Typewriter on Reading in the Elementary School." *Elementary English Review*, 13, pp. 291-4. December 1936.

² Cf. Fleming, C. M., *Individual Work in Primary Schools*. Chapter XVII. London: George G. Harrap & Co., Ltd. 1934.

³ Cf. *Interim Report on Vocabulary Selection for the Teaching of English as a Foreign Tongue*. London: P. S. King & Son Ltd. 1936. Bagley, D., "A Critical Survey of Objective Estimates in the Teaching of English." *British Journal of Educational Psychology*, VII, pp. 57-71 and 138-55. 1937.

frequency. For this reason a selection primarily prepared for adult use is not necessarily the best selection for children's readers,¹ and care requires to be taken lest a zeal for simplicity of structure destroys beauty of rhythm and correctness of idiom. Teachers are becoming sufficiently skilful in their judgment of text-books to ask authors to furnish evidence of properly balanced vocabulary, a reasonable number of repetitions of each word, and a type of sentence structure as well as of contents and printing which is suited to the age of the pupil who is to use the books. Further evidence on these points is still required. Little is yet known, for example, as to the best age-placement of materials of varying degrees of complexity. A start has, however, been made, and it is probable that the next decade will see a great improvement in the readability of text-books not only in English but in the content subjects, such as Arithmetic, History, Geography, and Science.

OUTLOOK FOR THE FUTURE

Investigations of the last two decades have extended the work described above. They have served to show that remedial treatment, well-selected text-books, adaptation to pupil's interests, and a wise variety of methods are needed in secondary schools as well as at the primary level.

Studies of the difficulties of older pupils are still, however, less complete than those of younger children. There are few tests of appreciation, interpretation, or ability to apply reading to the solution of problems. Little has been done to apply diagnostic methods to reading difficulties in the content subjects. There have been few attempts at long-term studies of individual learners at later stages² and practically no

¹ Cf. Gates, A. I., *A Reading Vocabulary for the Primary Grades*. New York: Teachers' College, Columbia University. 1926. Vernon, A. C., and P. E., *Word Counts of Infant Readers*. The Scottish Council for Research in Education. 1940. Vernon, A. C., and P. E., *The Vocabulary of Scottish Five-year-old Children*. The Scottish Council of Research in Education. 1943. See also: *Studies in Reading*, Vol. I. The Scottish Council for Research in Education, XXVI. London: University of London Press Ltd. 1948. *Studies in Reading*, Vol. II. Ibid, XXXIV. 1950.

² Cf. Bagley, D., "A Critical Survey of Objective Estimates in the Teaching of English." *British Journal of Educational Psychology*, VII, pp. 57-71 and 138-55. 1937. Center, S. S., and Persons, G. L., *Teaching High School Students to Read*. New York: D. Appleton-Century Co., Inc. 1937. McCallister, J. M.,

applications of the technique of factor analysis to the study of results of reading tests.

There is, however, reason to believe that at each level of school life the teaching of reading can be rendered more effective by intelligent educational diagnosis—careful formulation of aim, patient observation of the pupil's special interests as well as of his weaknesses, and critical examination of the content of the curriculum and the instructional material offered.

There is also increasing evidence that it is important to investigate not merely the social uses of skill in reading but the socialising influence of the practice of reading. It is becoming more fully realised that personal maladjustments may be prevented by well-planned reading programmes, and that excessive concentration in literature lessons on the analysis of a single text may wisely be replaced by extensive reading relevant to the social problems of the pupils.¹

It is also becoming more strongly believed that while failures in learning may be associated with lowness of intelligence, malnutrition, physical defects, inadequate sleep, unsuitable methods of tuition and the like, they are traceable also to handicaps which may be called social in origin—the treatment an individual has received from his companions and his teachers and his reactions to that treatment.²

Purposeful Reading in College. New York: D. Appleton-Century Co., Inc. 1942. "Improving Reading Instruction in the Secondary School," *Bulletin of the California State Department of Education*, XVI, 1. May 1947. Blair, G. M., *Diagnostic and Remedial Teaching in Secondary Schools*. New York: The Macmillan Company. 1947. Gray, W. S., et al., *Reading in the High School and College*. The Forty-seventh Yearbook of the National Society for the Study of Education. Part II. Chicago: University of Chicago Press. 1948.

¹ Cf. Rosenblatt, L. M., *Literature as Exploration*. New York: D. Appleton-Century Co., Inc. 1938. Wunsch, W. R., and Albers, E., *Thicker than Water*. New York: D. Appleton-Century Co., Inc. 1939. Lenrow, E., *Reader's Guide to Prose Fiction*. New York: D. Appleton-Century Co., Inc. 1940. Fleming, C. M., *The Social Psychology of Education*. London: Kegan Paul, Trench, Trübner & Co. Ltd. 1944. Woodring, M. N., et al., *Enriched Teaching of English in the Junior and Senior High School*. New York: Teachers' College, Columbia University. 1934. *Books for You*. Illinois: The National Council of Teachers of English. 1945. *Adventuring with Books*. Illinois: The National Council of Teachers of English. 1950. See also: White, D. N., *About Books for Children*. New Zealand Council for Educational Research. 1946. Trease, G., *Tales out of School*. Melbourne: William Heinemann Ltd. 1948. Russell, D. H., *Children Learn to Read*. Boston: Ginn & Company. 1949.

² Cf. Fleming, C. M., loc. cit.

Further evidence on such social repercussions may be expected when fuller use begins to be made of the developing techniques for the assessment of attitudes, values, ambitions, wishes and friendly relationships.¹ Sufficient has, however, been accomplished to indicate that the inspiration to be obtained from a study of the results of research in the field of reading is by no means at an end.

From present prospects it would appear that from these beginnings may come a revolution in methods and aims at the levels both of university education and of adult instruction in the widest sense of that term.

RESEARCH NEEDED

Research on the following topics would be useful:

Long-term studies of successful and unsuccessful readers with special reference to home background, parents' interests, stability of family life, etc.

Investigations into the effect upon reading ability of differing types of social climate.

Enquiries into the effect of different methods of grouping. (What happens when friends are allowed to co-operate in the class-room?)

Enquiries into the relative attractiveness (readability) of various types of printed materials for pupils of various ages.

Observation of motivation at various levels of reading-readiness.

Analysis of difficulties met with by retarded older pupils.

Studies of attitudes to school life and work in relation to levels of literacy.

The development of diagnostic tests in relation to school reading-books at various levels.

Factorial analysis of results of differing types of tests of reading-readiness.

Enquiries into the therapeutic effects of reading—reading as a form of psychotherapy, with children of various ages.

Study of the concomitants of literary appreciation.

¹ For an introduction to the relevance of sociometric techniques to the study of education see: Fleming, C. M., *Adolescence: Its Social Psychology*. London: Routledge & Kegan Paul Ltd. 1948; and Fleming, C. M., (ed.), *Studies in the Social Psychology of Adolescence*. London: Routledge & Kegan Paul Ltd. 1951.

Enquiries into the personal, social, and educational consequences of segregation according to ability. (What happens to pupils who are told that they are in the "C" group for reading?)

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CHAPTER III

ELEMENTARY MATHEMATICS

IN arithmetic, as in reading, the beginnings of modern investigations into methods of teaching can be traced to the intellectual curiosity of experimental psychologists in the middle of the nineteenth century. Tests¹ of computation were used as measures of attentiveness under distraction and of speed of working under differing physiological conditions. These early tests consisted of pages of examples of a specific type of calculation,² and there was no thought of modifying class-room procedure in the light of the evidence they gave.

As in the case of investigations into reading, the value of this early work lay in its revelation of the existence of individual differences and in the possibilities it suggested as to the probable effect of differing class-room conditions and attitudes upon performance. Its importance, however, was not realised until school surveys by psychologists at the beginning of the twentieth century raised questions as to the best methods of testing achievement in arithmetic and as to the causes of the widespread variability which such testing revealed.

EARLY SURVEY TESTS

The first survey tests were similar in type to those used in the psychological laboratories of the nineteenth century. They consisted of pages of exercises of approximately equal difficulty; and their results were analysed with a view to

¹ See Whipple, G. M., *Manual of Mental and Physical Tests*. Baltimore: Warwick & York, Inc. 1910.

² E.g. in addition

$$\begin{array}{r}
 4 \text{ or } 93 \text{ or } 42 \text{ or } 492 \text{ or } 64293643194831457627 \\
 7 \quad 68 \quad 79 \quad 763 \quad 38682725423585791858 \\
 - \quad 41 \quad - \quad - \quad \underline{\hspace{1.5cm}} \\
 \quad 25 \\
 \quad 52 \\
 \quad -
 \end{array}$$

studying differences in rate and accuracy. Interest was centred on the number of sums of a particular type which pupils at a certain age could do in a given number of minutes.¹

The conclusions reached were similar to those which followed from the contemporary use of standardised tests in reading. It was realised that the range of individual differences was very wide, and realisation of this led, as in the case of reading, to:

1. a critical examination of class-room organisation and procedure;
2. a more careful analysis of the factors which accompany failure;
3. the development of tests of a more comprehensive type.

CLASS-ROOM ORGANISATION AND PROCEDURE

School arithmetic in the late nineteenth century was organised on class lines with a thoroughness as rigid as that shown in the handling of reading. Text-books were few in number, closely printed, and packed with examples of a lengthy and involved kind. They were written for teachers rather than for pupils; and their authors assumed that the teacher would give elaborate oral demonstrations and detailed oral explanations at each new step. In many instances the examples they contained were dictated by the teacher or copied by the pupils from the blackboard. The value put on prowess in arithmetic was so great that almost half the school day was given to the working of exercises, the transcription of figures from the blackboard, or the listening to explanations as to how answers had been obtained.² Criticism of the excessive time expended in this way began in the last decade of the nineteenth century, and from about 1910 onwards a series of researches was conducted with a view to the

¹ For examples of these earlier tests see: Starch, D., *Educational Measurements*. New York: The Macmillan Company. 1916. Ballard, P. B., *Mental Tests*. London: Hodder & Stoughton Ltd. 1920. Burt, C., *Mental and Scholastic Tests*. London: P. S. King & Son Ltd. 1921.

² Cf. *The Scientific Movement in Education*. Thirty-seventh Yearbook of the National Society for the Study of Education. Chapter X. Bloomington, Illinois: Public School Publishing Company. 1938.

elimination of what was described as "lumber"¹ or "dead wood."

ENQUIRIES INTO SOCIAL USES OF ARITHMETIC

The earliest of these investigations consisted of surveys of the social and business uses of arithmetic.² Analysis was made of newspapers, factory pay-rolls, shopping and banking transactions to discover the arithmetical processes which ordinary people used in ordinary living. At a later date enquiries were made into the arithmetic employed by pupils in play-time and school-room activities, and into the geometry and algebra needed for the study of other subjects, such as physics, chemistry, and the social sciences. These investigations provided valuable arguments for those who were trying to limit the merely academic ambitions of certain teachers. They led to greater insight into the interests and activities of pupils and therefore made it more easy to win active co-operation by providing pupils with a motive for learning. By an unfortunate over-emphasis on the mere manipulation of figures, however, they often resulted in superficial treatment and a limitation of aim to that of mere efficiency in computation.

EMPHASIS ON THE COMPUTATIONAL ASPECTS OF ARITHMETIC

The development of practice exercises³ based on the simpler forms of tests tended in the same direction. Competent teachers were expected to secure a hundred per cent. mastery of the narrow range of processes presented in these tests, and justification for their emphasis on repetitive drill was readily found in contemporary explanations, of the process of learning in terms of "stimulus-response," "the establishment of bonds," and the like.

¹ Cf. Wilson, G. M., *What Arithmetic shall we Teach?* Boston: Houghton Mifflin Company. 1926. A useful summary of recent studies is given in Wilson, G. M., Stone, M. B., and Dalrymple, C. O., *Teaching the New Arithmetic*. Chapters XIII, XVII, XVIII. London: McGraw-Hill Publishing Co., Ltd. 1939.

² See: Wilson, G. M., *A Survey of the Social and Business Use of Arithmetic*. Sixteenth Yearbook of the National Society for the Study of Education. Part I, Chapter VIII. Bloomington, Illinois: Public School Publishing Company. 1917.

³ Early examples of these were the practice exercises of Courtis, Studebaker, and Thompson, e.g. *Courtis Standard Practice Tests in Arithmetic*. New York: World Book Company. 1914.

This interest in efficient computation was, however, responsible for a great increase in definiteness in the arithmetic programme. Enquiries were begun as to what was implied in a thorough knowledge of addition, subtraction, multiplication, or division; and lists were made of the basic facts, higher decade additions, higher decade subtractions, short divisions involving carrying, and so on.¹

The inclusion of these items in text-books made it more possible at a later date for teachers to arrange for thorough diagnosis of difficulties and adequate provision of remedial treatment.

CRITICISM OF EXISTING TEXT-BOOKS

Alongside discussion of the curriculum went criticism of the contents of existing text-books. This followed lines similar to contemporary criticism of reading-books. In the case of reading, there was considerations of the number of words used, the frequency of their use, and the type of sentence structure which was suitable at each stage. In the corresponding analysis of materials in arithmetic, questions were asked as to the amount of practice which was given to each process, and the number of times each "combination" (5×4 , $5 + 4$, $5 - 4$, etc.) appeared in each series of text-books.²

Distressing inequalities were revealed. In one popular arithmetic, for example, it was found that 2×2 was exercised 668 times, while 9×8 was practised only 82 times. Certain types of difficulty in subtractions, addition, long division, or multiplication did not appear at all, while others received a disproportionate amount of exercise. Authors of competently constructed text-books began therefore to publish analyses of the contents of their books and to indicate in detail the contents of each section and the frequency of appearance of each process and each combination.

¹ See Osburn, W. J., *Corrective Arithmetic*. Boston: Houghton Mifflin Company. 1924 and 1929. Buckingham, B. R., *Elementary Arithmetic: Its Meaning and Practice*. Boston: Ginn & Company. 1947. *Addition and Subtraction Facts and Processes*. Scottish Council for Research in Education, XXVIII. London: University of London Press Ltd. 1948.

² Cf. Thorndike, E. L., *The Psychology of Arithmetic*. New York: The Macmillan Company. 1922. See also Ballard, P. B., *Teaching the Essentials of Arithmetic*. London: University of London Press Ltd. 1928.

A further step was taken when questions were raised as to the relative difficulty of the combinations and as to the optimum amount and distribution of practice¹ which each combination should receive. The results of these enquiries were somewhat conflicting; and they were hard to interpret, since apparent differences in difficulty might be due to variations in the amount and nature of the practice given. It was, however, established that zero combinations and combinations involving the figures 7, 8, and 9 showed a higher percentage of error, took longer to learn, were learned less completely in a given time, or evoked a slower response than combinations involving the smaller numbers, such as 2, 3, or 4.

Comparable investigations were next undertaken into the vocabulary of arithmetic text-books. If pupils were to use these books with some degree of independence, it was important that their vocabulary should be understood. Criteria found useful in criticism of school reading-books were therefore applied to school arithmetics. It was discovered that quite unnecessary difficulties were arising through the introduction of a large variety of words, both technical and general.² As many as 1,345 different words were said to appear, for example, in one series in pages of exercises on very elementary processes, and of these 1,214 were used less than four times. Pupils about the age of nine were found to be unable to solve problems because of ignorance of the meanings of words such as broker, cashier, cistern, commission, expenses, fares, income, insurance, mason, owe, profit, rent, teamster, wages; and pages of problems lacked interest and reality because they consisted of totally disparate verbal puzzles on disconnected items of adult experience.

At this point a return was made to the principle of social

¹ See: Thorndike, E. L., *The Psychology of Arithmetic*. New York: The Macmillan Company. 1922. Buswell, G. T., and Judd, C. H., *Summary of Educational Investigations Relating to Arithmetic*. Chicago: University of Chicago. 1925. Washburne, C., and Vogel, M., "Are any Number-combinations Inherently Difficult?" *Journal of Educational Research*. XVII, pp. 235-55. 1928. See also: *Studies in Arithmetic*. Vol. I. Publications of the Scottish Council for Research in Education. XIII, pp. 79-116. London: University of London Press Ltd. 1939.

² Cf. Brueckner, L. J., *Diagnostic and Remedial Teaching in Arithmetic*. Chapters VII and IX. Chicago: The John C. Winston Company. 1930.

and business utility, not with the purpose of limiting experience to the few computations which could be observed in written records of transactions, but with the intention of utilising the wealth of quantitative thinking implied in modern social life. It was suggested that arithmetic should be informational¹ rather than computational, social rather than mechanical—that it should make pupils familiar with all the contributions that number has made to human progress in business, science, industry, and civil life.

As a consequence of these discussions, text-books began to appear which based vocabulary and problem-solving on a series of typical life activities, interests, or projects, and stories from the history of mathematics were used to lend interest to present-day employment of number.²

The difficulties involved in problem-solving were next studied from the point of view of their technical vocabulary; and attempts were made to anticipate difficulties by producing pre-number readers,³ which would incorporate in story-form the terminology of addition, subtraction, multiplication, and division. All possible variations of quantitative thinking can-

¹ Cf. Twenty-ninth Yearbook of the National Society for the Study of Education (chapter by reviewing committee). Bloomington, Illinois: Public School Publishing Company. 1930; and, with a slightly different emphasis, *The Teaching of Arithmetic*. Tenth Yearbook of the National Council of Teachers of Mathematics. New York: Teachers' College, Columbia University. 1935; and Wheat, H. G., *The Psychology and Teaching of Arithmetic*. Boston: D. C. Heath & Company. 1937.

² For examples of these see: Smith, D. E., *Number Stories of Long Ago*. Boston: Ginn & Company. 1919; *The Wonderful Wonders of One-Two-Three*. New York: McFarlane, Warde, McFarlane. 1937. More advanced discussions of a similar type may be found in Smith, D. E., and Ginsburg, J., *Number and Numerals*. New York: Teachers' College, Columbia University. 1937; and teachers will find stimulation for their own thinking in such books as Hogben, L., *Mathematics for the Million*. London: Allen & Unwin Ltd. 1935. Smith, D. E., *Mathematics and Religion*. Sixth Yearbook of the National Council of Teachers of Mathematics. New York: Teachers' College, Columbia University. 1931. Sanford, V., *A Short History of Mathematics*. London: George G. Harrap & Co., Ltd. 1931. Yeldham, F. A., *The Teaching of Arithmetic through Four Hundred Years. 1535-1935*. London: George G. Harrap & Co., Ltd. 1936.

³ E.g. Smith, D. E., Luse, M., and Morss, E. L., *Walks and Talks in Numberland*. Boston: Ginn & Company. 1929. Buswell, G. T., Brownell, W. A., and John, L., *Jolly Number Tales*. Boston: Ginn & Company. 1937. Fleming, C. M., and Grassam, E. H., *The Beacon Number Reader*. London: Ginn & Company, Ltd. 1939.

not, of course, be introduced and exercised, but investigations showed that competence was increased by giving deliberate practice in such types¹ as:

ADDITION. Finding the number in unequal groups.

What is the total number (cost, length, savings, etc.)?

How many (much) in all?

How many (much) altogether?

SUBTRACTION. Finding differences.

(a) How many are left?

How much money (length, weight, etc.) left?

(b) How much more or less (longer, heavier, older, etc.)?

How many more or fewer?

(c) How much (many) more is needed?

How many (much) more must be added?

(d) What has been lost (taken away)?

What has been gained?

MULTIPLICATION. Finding the number in equal groups.

(1) . . . in one, how many in . . . ?

(2) . . . cost (length, weight, etc.) of one . . . how much is
cost (length, weight, etc.) of . . . ?

(3) Of what number is . . . a . . . fraction?

DIVISION.

(a) How many . . . 's are in . . . ?

. . . what is the cost (weight, etc.) of one?

(b) What is . . . shared equally among . . . ?

What is . . . divided into . . . equal parts?

(c) What is one . . . th part of . . . ?

(d) What part of . . . is . . . ?

Guidance in the solution of problems can also, with advantage, be given by accustoming pupils to solve problems without numbers, and, at later stages, to make analyses on adult lines into—

1. What does it mean?

2. What are we told?

3. What are we asked to discover?

¹ Cf. Brueckner, L. J., *Diagnostic and Remedial Teaching in Arithmetic*. Chicago: The John C. Winston Company. 1930; and *Classified Problems in Arithmetic* by the Committee of Seven, Northern Illinois Conference on Supervision. Winnetka, Illinois: Winnetka Educational Press. 1934.

4. How can we find the answer?
5. What is the answer likely to be?

Experiments showed that time spent in such ways on problems arising from meaningful activities and from the experiences of pupils inside and out of school produced better results than a corresponding amount of practice on the unrelated artificial problems of the older text-books.¹

THE NATURE OF MATHEMATICAL THINKING

Contemporary with this work went an increasing emphasis on the importance of insight in contrast to mechanical learning in the development of every type of arithmetical and mathematical ability. Interest in the nature of mathematical thinking is known to be older than the days of Plato, but twentieth-century treatment of test results by factor-analysis has made it possible to isolate with more certainty various types of activity involved.²

¹ Recent researches are summarised in: Wilson, G. M., Stone, M. B., Dalrymple, C. O., *Teaching the New Arithmetic*. Part III, Chapter XXVI. London: McGraw-Hill Publishing Company Ltd. 1939. See also: *Mathematics in General Education*. New York: D. Appleton-Century Company, Inc. 1940. *The Place of Mathematics in Secondary Education*. The Fifteenth Yearbook of the National Council of Teachers of Mathematics. New York: Teachers' College, Columbia University. 1940. *Arithmetic in General Education*. The Sixteenth Yearbook of the National Council of Teachers of Mathematics. New York: Teachers' College, Columbia University. 1941. Butler, C. H., and Wren, F. L., *The Teaching of Secondary Mathematics*. New York: McGraw-Hill Book Company, Inc. 1941.

² Cf. Rogers, A. L., *Experimental Tests of Mathematical Ability and their Prognostic Value*. New York: Teachers' College, Columbia University. 1918. Burt, C., *The Distribution and Relations of Educational Abilities*. London: P. S. King & Son Ltd. 1917. Burt, C., "The Development of Reasoning in School Children." *Journal of Experimental Pedagogy*, V, pp. 68-77, 121-7. 1919. Collar, D. J., "A Statistical Survey of Arithmetical Ability." *British Journal of Psychology*, XI, pp. 135-58. 1920. Flack, W. S., "Investigation of Mathematical Ability in the Class-room." *Forum of Education*, IV, pp. 44-56. 1926. Hughes, A. G., "The Psychology of Mathematical Ability." *The Mathematical Gazette*, XIV, pp. 205-14. London: G. Bell & Sons Ltd. 1928. Koussy, A. A., "The Visual Perception of Space." *British Journal of Psychology*. Monograph Supplement XX. London: Cambridge University Press. 1935. A useful bibliography is given in: Mitchell, F. W., *The Nature of Mathematical Thinking*. Australian Council for Educational Research. Melbourne: University Press. 1938.

See also: Spearman, C., *The Abilities of Man*. London: Macmillan & Co., Ltd. 1927. Kelley, T. L., *Crossroads in the Mind of Man*. California: Stanford

The chief practical importance of these researches lay in their reminder that mathematical ability is complex, that it includes more than mere skill in manipulation of figures, more than mere memorising of processes or tables, and more than mere verbal aptitude or imagery of a specialised type. Ability to see relationships, to recognise correspondences, to classify and to order the ordinary experiences of life form no small part of the activity promoted by the teaching of mathematics.¹

Support for this position may be found in the modified interpretations of the process of learning associated with the experimentation of the Gestalt Psychologists; and an increasing understanding of its implications is probably the most important contribution of the researches of the last fifteen years.²

CRITICISM OF MASS TEACHING

Criticism of mass methods of teaching in arithmetic followed the same lines as did the corresponding trend towards more

University Press. 1928. Thurstone, L. L., *Primary Mental Abilities*. Chicago: University of Chicago Press. 1938. Appleby, E., *Factorial Analysis of the Development of Arithmetical and other Abilities in Junior School Children*. Unpublished Ph.D. thesis. London: University Library. 1939. Jenkins, J. W., *A Factor-Analysis of Certain Tests of Mathematical Ability*. Unpublished Ph.D. thesis. London: University Library. 1939. Piaget, J., et al., *La Genèse du Nombre chez l'Enfant*. Neuchatel: Delachaux et Niestlé S.A. 1941. Johannot, L., *Le Raisonnement Mathématique de l'Adolescent*. Neuchatel: Delachaux et Niestlé S.A. 1947.

¹ Cf. Hamley, H. R., "Formal Training: A Critical Survey of Experimental Work." *British Journal of Educational Psychology*, VI, pp. 233-49. 1936. See also: with special reference to more advanced mathematics: Breslich, E. R., *Problems in Teaching Secondary School Mathematics*. Chicago: University of Chicago Press. 1931; and with reference also to the work of Klein, Nunn, and Lietzman in developing the function concept, Hamley, H. R., *Relational and Functional Thinking in Mathematics*. Ninth Yearbook of the National Council of Teachers of Mathematics. New York: Teachers' College, Columbia University. 1934. Cf. *The Scientific Movement in Education*. Thirty-seventh Yearbook of the National Society for the Study of Education. Part II. Chapter X. Bloomington, Illinois: Public School Publishing Company. 1938.

² Cf. *Arithmetic in General Education*. Sixteenth Yearbook of the National Council of Teachers of Mathematics. New York: Teachers' College, Columbia University. 1941. Stern, C., *Children Discover Arithmetic*. New York: Harper & Brothers, Publishers. 1949. See also: Katona, G., *Organizing and Memorizing*. New York: Columbia University Press. 1940; and Fleming, C. M., *The Social Psychology of Education*. London: Kegan Paul, Trench, Trübner & Company Ltd. 1944.

individualised instruction in reading, and it led by similar stages to the use of text-books suitable for self-aided study,¹ and later to the introduction in America about 1930 of "work books" which eliminated unnecessary transcription by permitting pupils to write answers directly on to their text-books.²

Such individual text-books and work-books have the advantage that they provide children with an adequate amount of material on which they may practise more or less independently while the teacher is set free to give attention to the special needs of other pupils who may be in difficulty. They reduce the time wasted on extraneous activities such as copying from blackboards or text-books. They protect teachers against the temptation to supplement a meagre text-book by exercises constructed at random.³ For these reasons they are rapidly becoming recognised as part of a pupil's equipment for the learning of arithmetic.

Ultimate success in arithmetic (even more than in other primary-school subjects) is attained through step by step mastery of each new process as it is encountered. Arithmetic is therefore a subject in which individual work is imperative.⁴

Variations in attendance, health, speed, intelligence, and interest probably produce more marked differences among pupils in this subject than in any other comparable branch of school work.

CONDITIONS ACCOMPANYING FAILURE

Contemporary with changes in class-room materials, organisation and emphasis, went clinical studies of the accompaniments of success or failure. Four methods were used:

¹ One of the first and most influential of these was: Thorndike, E. L., *The Thorndike Arithmetics*. Chicago: Rand, McNally & Company. 1917 and 1924.

² E.g. *The Alpha Individual Arithmetics*. Boston: Ginn & Company. 1929; and Buswell, G. T., Brownell, W. A., and John, L., *Jolly Numbers*. Boston: Ginn & Company. 1937.

³ "Work-books," however, have the disadvantage that they can be used only once, and that they discourage pupils from attempting to work over again examples in which errors have been made. Some of the satisfaction of conquest of difficulties is therefore prevented and the cost of the series is increased, since the books have to be large enough to provide sufficient revision for every pupil.

⁴ Cf. *Handbook of Suggestions for the Consideration of Teachers and Others concerned in the Work of Public Elementary Schools*. London: His Majesty's Stationery Office. 1937.

(1) Processes were analysed into their component parts and an effort was made to determine the frequency of errors in each.

(2) Pupils were asked to explain how they arrived at wrong answers.

(3) Pupils were set to solve calculations aloud and comparison was made of methods employed by successful and unsuccessful workers.

(4) Physical and psychological examinations were also conducted. Observations were made of temperamental attributes, attitudes, speed of working, personal history, and social background; and, in a fashion similar to that used in case-studies of reading, attempts were made to see each problem pupil in his complete environmental setting.¹

DISABILITIES IN ARITHMETIC

As a result of such studies it was found, as in the comparable case of reading, that the factors associated with failure were very varied and that a pupil's progress at any level was influenced by his physical, mental, social, and emotional condition.

Visual difficulties, auditory difficulties, motor difficulties, intellectual difficulties, difficulties due to faulty teaching methods or inadequate and uninteresting material, irregular schooling, emotional imbalance, and a poor home background may be responsible for weakness in arithmetic to as great an extent as they may prove decisive in the history of a pupil who experiences failure in reading.

ANALYSIS OF PROCESSES

Perhaps the most immediately obvious result of the diagnostic study of pupils and their difficulties was the analysis of processes, both in computation and in problem-solving, into a much greater number of steps than had previously been thought necessary.²

¹ Cf. *Educational Diagnosis*. Thirty-fourth Yearbook of the National Society for the Study of Education. Chapter XIV. Bloomington, Illinois: Public School Publishing Company. 1935. Burt, C., *The Backward Child*. London: University of London Press Ltd. 1937.

² Cf. Brueckner, L. J., *Diagnostic and Remedial Teaching in Arithmetic*. Chicago: The John C. Winston Company. 1930. See also: Schonell, F. J., *Diagnosis of Individual Differences in Arithmetic*. Edinburgh: Oliver & Boyd Ltd. 1937.

Instead, for example, of a classification of examples in addition as merely "easier" or "harder," the following gradations of difficulty are typical¹:

1.	$\begin{array}{r} 11 \\ 3 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ 13 \\ \hline \end{array}$		No carrying. Answers below 30.
2.	$\begin{array}{r} 22 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ 66 \\ \hline \end{array}$		No carrying. Answers below 100.
3.	$\begin{array}{r} 23 \\ 9 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 18 \\ \hline \end{array}$		Carrying from units. Answers below 40.
4.	$\begin{array}{r} 26 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 36 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 46 \\ 5 \\ \hline \end{array}$	Bridging the tens.
5.	$\begin{array}{r} 69 \\ 7 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 75 \\ \hline \end{array}$		Carrying from units. Answers below 100.
6.	$\begin{array}{r} 14 \\ 2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 57 \\ \hline \end{array}$		Mixed revision.
7.	$\begin{array}{r} 21 \\ 13 \\ \hline \end{array}$	$\begin{array}{r} 140 \\ 530 \\ \hline \end{array}$		No carrying.
8.	$\begin{array}{r} 35 \\ 834 \\ \hline \end{array}$	$\begin{array}{r} 1050 \\ 917 \\ \hline \end{array}$		No carrying.
9.	$\begin{array}{r} 42 \\ 81 \\ \hline \end{array}$	$\begin{array}{r} 94 \\ 35 \\ \hline \end{array}$		Carrying from tens.
10.	$\begin{array}{r} 18 \\ 34 \\ \hline \end{array}$	$\begin{array}{r} 342 \\ 219 \\ \hline \end{array}$		Carrying from units.
11.	$\begin{array}{r} 63 \\ 81 \\ \hline \end{array}$	$\begin{array}{r} 43 \\ 39 \\ \hline \end{array}$	$\begin{array}{r} 663 \\ 826 \\ \hline \end{array}$	Carrying from tens or units or hundreds.
12.	$\begin{array}{r} 87 \\ 43 \\ \hline \end{array}$	$\begin{array}{r} 51 \\ 79 \\ \hline \end{array}$		Carrying from both units and tens.
13.	$\begin{array}{r} 237 \\ 395 \\ \hline \end{array}$			Three columns. Carrying from units and tens.
14.	$\begin{array}{r} 896 \\ 834 \\ \hline \end{array}$	$\begin{array}{r} 345 \\ 230 \\ \hline \end{array}$		Carrying from units, tens, and hundreds (mixed with revision of no carrying).

¹ Cf. Fleming, C. M., *Manual to the Beacon Arithmetic*. London: Ginn & Company Ltd. 1939 and 1948.

15.	$(4 + 1) + 7$	Addition of seen to thought-of numbers below 10.
16.	$\begin{array}{r} 76 \\ 13 \\ 45 \\ \hline \end{array}$	Two columns. Addition of seen to thought-of numbers below 10.
17.	$\begin{array}{r} 102 \\ 470 \\ 952 \\ \hline \end{array}$	Three columns.
18.	$(6 + 6) + 5$	Addition of seen to thought-of numbers above 10.
19.	$\begin{array}{r} 19 \\ 40 \\ 9 \\ 3 \\ \hline \end{array}$	Two columns with empty places. Addition of seen to thought-of numbers above 10.
20.	$\begin{array}{r} 462 \\ 501 \\ 721 \\ 423 \\ \hline \end{array}$	Three columns, four deep. Carrying and no carrying.
21.	$\begin{array}{r} 4136 \\ 1926 \\ 3725 \\ \hline \end{array}$	Carrying in alternate places.
22.	$\begin{array}{r} 109 \\ 6605 \\ 4404 \\ \hline \end{array}$	One to four columns. Three to six deep. Carrying to empty places and to zero.
23.	Advanced Addition	As above. Wider and deeper.

Adequately constructed text-books have henceforth to take account of most of these steps, and from the evidence so far obtained it seems likely that pupils' difficulties will be lessened through a reduction in the number of unclassified and unexplained difficulties which they will then meet in the course of their practice.

STUDY OF PUPILS' ERRORS

Studies of errors have led in the same direction. The older type of discussion was content to speak of inattention and carelessness on the part of the pupil. Interest has turned now from such mere criticism to a careful enquiry into exactly the mistake which a pupil does make; and provision is made

in teaching materials for the prevention of each of the main types of error that have been discovered. Difficulties are isolated, model examples are given with explanations in words suited to the pupils' mental level, and exercises are graded so that it is possible for a pupil to experience the joy of success at each step and to progress to mastery by almost imperceptible stages.

Prevention of error through wisely planned activities, suitable vocabulary, and step by step progress is therefore among the aims of more recent arithmetical text-books.

Examples of pupils' errors in a process such as addition may, for instance, be classified as follows:

1. Ignorance of certain combinations.
2. Addition of the same digit to a second column.
3. Difficulty in bridging the tens.
4. Attempt at wrong operations.
5. Mixture of operations.
6. Ignorance of carrying.
7. Carrying of wrong number.
8. Omission of carrying.
9. Beginning with wrong column.
10. Addition of second column to first.
11. Zero difficulties.
12. Difficulties with unseen numbers.
13. Difficulties with empty spaces in columns.

Similar lists can be made for each of the other processes; and, equipped with such lists, teachers can more readily discover the exact type of help required by each pupil.

DIAGNOSTIC TESTING

The analytic interest stimulated by such clinical studies led to the construction of more comprehensive tests.¹ These first took the form of survey tests which consisted of a few examples from differing levels of difficulty, ranging within one page from easiest to most difficult. They were useful for the determination of arithmetic ages (for comparison with mental ages and subsequent calculation of accomplishment quotients), but it was soon evident that more detailed study of each

¹ For a survey of such tests, see: Schonell, F. J., in Hamley, H. R., *The Testing of Intelligence*. Chapter IX. London: Evans Brothers Ltd, 1935.

process would provide information which would lead to more accurate educational diagnosis. Diagnostic testing then superseded mere survey testing and a momentous step forward was taken when it was realised that such tests were most useful when they were incorporated in text-books and when pages of practice were so arranged that from the position of errors in the diagnostic tests reference might be made to the appropriate remedial exercises.¹

Various methods of arranging these tests and their keys were employed; but the most useful is probably that in which a column² is given to each type of difficulty and the key reference to the appropriate lesson appears at the foot of the column.

AGE-PLACEMENT

A further result of the fuller understanding which followed clinical study of pupils' difficulties in each process was the raising of the question as to whether the processes were being presented in the best order and at the most suitable stage in the pupil's development. Enquiries into the age-placement of the various topics showed that waste of time and effort resulted from attempting to teach a process too soon. Teachers exerted themselves without effect and pupils suffered from unnecessary experiences of defeat.³ There seems to be a minimum mental age at which each operation can be mastered, and there is also apparently an optimum age at which least

¹ Cf. Washburne, C., and Carswell, M., *Washburne Individual Arithmetic*. Yonkers-on-Hudson, New York: World Book Company. 1927. Brueckner, L. J., Anderson, C. J., Banting, G. O., and Merton, E. L., *The Triangle Arithmetics*. Chicago: The John C. Winston Company. 1928.

² Cf. Fleming, C. M., *Beacon Diagnostic Arithmetic Tests*. London: Ginn & Company Ltd. 1949.

³ Cf. Washburne, C. W., "Mental Age and the Arithmetic Curriculum." *Journal of Educational Research*, XXIII, pp. 210-31. 1931. Washburne, C. W., "The Values, Limitations and Applications of the Findings of the Committee of Seven." *Journal of Educational Research*, XXIX, pp. 694-707. 1936. Brueckner, L. J., *The Development of Ability in Arithmetic*. Thirty-eighth Yearbook of the National Society for the Study of Education. Part I, Chapter XV. Bloomington, Illinois: Public School Publishing Company. 1939. Washburne, C., "The Work of the Committee of Seven on Grade-Placement in Arithmetic." Ibid. Chapter XVI. Curr, W., "Placement of Topics in Arithmetic," in *Studies in Arithmetic*, Vol. II. Scottish Council for Research in Education, XVIII. London: University of London Press Ltd. 1941.

expenditure of effort is necessary and greatest retention is effected.

As in the case of comparable researches into reading, it has, however, to be noted that evidence at present is limited to findings with one type of teaching method. With different methods and different time-limits, different results might be obtained. While maturity is undoubtedly a factor in success, the final decision as to the placement of topics still depends upon one's philosophy of education and the relationship of mathematics to other experiences in the life of the child. Wholesale regrading of topics in arithmetic cannot safely be attempted in the light of present evidence, and the most important result of investigations into age-placement is probably to be seen in the increasing sensitiveness of teachers and administrators to the possibility of improvement in the accepted sequence and treatment of arithmetical processes.

It is realised that curtailment and postponement of topics may result in increased competence, that infant teachers are wise to secure a background of knowledge of quantitative thinking before beginning work with abstract numbers, that active practice in measurement and an introduction to the history of measurement in place of mere study of tables is not a waste of time. Enquiries into age-placement have lent support to the findings of earlier investigations as to desirable curtailment of courses of study at the elementary stages, and their results make it unlikely that attempts will be made to reintroduce into the primary school discarded topics such as long and confusing problems in vulgar fractions, annual interest, compound interest, cases two and three in percentage, apothecaries' weight, cube root, greatest common factor and least common multiple (beyond the power of inspection), troy weight, etc.

Studies of age-placement of topics have also served to direct attention to varying degrees of learning-readiness, both among beginners¹ and at later stages.² Adaptation of teaching

¹ For valuable evidence and a good bibliography see: *The Early Development of Number Concepts*. Scottish Council for Research in Education. XX. London: University of London Press Ltd. 1942. See also: Fleming, C. M., *Beacon Number Manual*. London: Ginn & Company Ltd. 1948.

² See: Mallory, V. S., *The Relative Difficulty of Certain Topics in Mathematics for Slow-moving Ninth Grade Pupils*. New York: Teachers' College, Columbia University. 1939.

to individual differences and educational guidance based on diagnosis are more fruitful procedures than a continuance of mass presentation of topics to pupils who may be educationally unready. Investigators of age-placement do not intend to encourage a revival of class instruction, but there is some danger that their findings may have that effect. There is reason to believe that, while mentally older starters (of higher I.Q.) do learn more swiftly, a better index of success is to be found in performance on a suitable diagnostic test than in a mere consideration of mental age.¹

THE FINDINGS OF RESEARCH

While it is difficult to dogmatise with certainty on the findings of research in so complex a subject as the teaching of elementary mathematics, it seems safe to say that the following conclusions² may be accepted.

Systematic drill increases achievement and is more effective when it includes all number combinations and when the amount of practice on each combination is roughly proportionate to its difficulty.

Drill should be subsequent to, and not a substitute for, understanding of meaning; and every encouragement should be given to the recognition of relationships.

For the acquisition of skill, practice on isolated difficulties and processes is more helpful than practice on mixed material. Much experience with isolated difficulties in small sums is therefore better than the attempted solution of a smaller number of unwieldy calculations of greater complexity.

For the maintenance of skill a mixture of material is most useful. A combination of written work and oral exercises produces better results at each stage than does either oral or written drill alone.

¹ Cf. Curr, W., loc. cit.

² A valuable summary of research on topics relevant to English schools is given in a recent digest of conclusions reached in Scottish Investigations. See: Morrison, J., *The Teaching of Arithmetic*. Scottish Council for Research in Education. XXI. London: University of London Press Ltd. 1943. To it reference may be made for findings on the success of teaching subtraction by the method of equal additions, on the relative difficulty of the number combinations, on the interpretation of the symbol X as "multiplied by," on the placement of topics, and on a desirable minimum content for a Primary School Scheme of Work. Evidence for these is not repeated here.

Careful gradation of material so that the difficulty involved in any new step is not great makes it unnecessary for children to use "crutches" and prevents the later retardation which results from the use of methods which have afterwards to be discarded.¹ The use of "crutches" is usually an indication that the gradation of material has been poor and its difficulty too great.

Text-books should be criticised from the point of view of their contents—both verbal and computational. Evidence should be provided by their authors that the range of vocabulary is not too wide, that every combination receives adequate practice, and that opportunities are given for exercise in each type of difficulty.

Diagnosis and remedial work are highly effective. Provision for these should be included in text-books, and the burden of the teacher is lightened if text-books are suited for silent study and for pupils' self-correction of routine work. Individualised methods and adaptation of practice to the needs of the pupils produce better results than mass methods of instruction.

Training in problem-solving should follow the same lines as drill in computation. Difficulties should be isolated and practice should first be given to each type by itself. Revision should consist of a mixture of types, and emphasis should throughout be on the development of insight and understanding.

Vocabulary studies and training in the understanding of terms are as important in mathematics as they are in the comparable subject of reading.

The use of flash cards and games is helpful in developing speed both in computation and in the use of the language of mathematics.

The informational and social uses of mathematics require emphasis in a well-balanced course; and more interest is won if definite provision is made for pupil activity and co-operation both in the execution of simple relevant projects and in the devising of problems and examples. Formal instruction and definite systematic practice are, however, essential to mastery.

¹ Samples of such methods are counting on the fingers, writing numbers to be carried, breaking of columns, making tens, jumping figures in addition, rewriting numbers in minuend or subtrahend.

Information as to progress made and success achieved provides a valuable incentive, and a pupil's competition with his own record in timed tests gives increased interest in the development of accuracy and speed.

Learning that is attempted without emotional strain and under conditions that promote happy activity wins greater success than a comparable effort made with the expectation of failure or to the accompaniment of jealousy and rivalry.

In arithmetic, as in reading, the findings of recent research have helped to raise the status of the teacher from that of a mere instructor to that of a diagnostician skilled in the detection of weaknesses and able through sympathy, encouragement, and wisely applied knowledge to guide pupils to the satisfactions of success in a subject which was once for many a source of sorrow but need now provide only the joyful experiences of the accomplishment of tasks adjusted to the intellectual competence of each pupil.

In arithmetic, as in reading, the sociological emphasis of thirty years ago is giving place to a realisation of the socialising influence of achievement and of the contribution to future personal adequacy which can be made by conquest of the basic skills necessary to successful living. Early and efficient teaching in the fundamentals of reading, writing, and arithmetic is increasingly admitted to be "the corner-stone of mental health" in school children,¹ and the resulting attitudes towards learning among adults as well as among children are becoming more fully recognised as directly related to satisfactory social relationships and the maintenance of civilian morale.²

RESEARCH NEEDED

Investigations are desirable on the following lines:

Enquiries into the effect of mathematical failure or success upon personal adjustment.

Studies of successful and unsuccessful learners in relation to family background, parental attitudes, etc.

¹ Cf. Moodie, W., *The Doctor and the Difficult Child*. New York: Commonwealth Fund. 1940.

² Cf. Morris, K. E., *The Three R's and the Adult Worker*. Montreal: McGill University. 1940. See also: Fleming, C. M., *Adolescence: Its Social Psychology*. London: Routledge & Kegan Paul Ltd. 1948.

Observation of motivation at various levels of mathematical competence.

Comparison of the effects of differing methods of classroom organisation (grouping by friendship, etc.).

Investigations into learning under differing types of social climate.

Long-term studies of the origins and the correction of various types of computational difficulties.

Enquiries into the observable consequences of irregular attendance, change of school or change of method of working.

Enquiries into usefulness of diagnostic tests of number-readiness at various levels.

Comparison of effectiveness of work-books, traditional text-books, and self-instructive materials at various levels and from the point of view of attitude as well as attainment.

BRIEF BIBLIOGRAPHY OF REFERENCES RELEVANT TO THE STUDY OF ELEMENTARY MATHEMATICS

A. Specimens of *tests of differing types* may be found in:

STARCH, D., *Educational Measurements*. New York: The Macmillan Company. 1916.

BALLARD, P. B., *Mental Tests*. London: University of London Press Ltd. 1920.

BURT, C., *Mental and Scholastic Tests*. London: P. S. King & Son Ltd. 1921.

HAMLEY, H. R., *The Testing of Intelligence*. London: Evans Brothers Ltd. 1935.

B. *Analysis of processes* is described in:

THORNDIKE, E. L., *The Psychology of Arithmetic*. New York: The Macmillan Company. 1922.

OSBURN, W. J., *Corrective Arithmetic*. Boston: Houghton Mifflin Company. 1924 and 1929.

BALLARD, P. B., *Teaching the Essentials of Arithmetic*. London: University of London Press Ltd. 1928.

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SCHONELL, F. J., *Diagnosis of Individual Difficulties in Arithmetic*. Edinburgh: Oliver & Boyd Ltd. 1937.

BUCKINGHAM, B. R., *Elementary Arithmetic: Its Meaning and Practice*. Boston: Ginn & Company. 1947.

C. *Evidence on relative difficulty* may be found in:

- BUSWELL, G. T., and JUDD, C. H., *Summary of Educational Investigations relating to Arithmetic*. Chicago: University of Chicago. 1925.
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CHAPTER IV

EXPRESSION IN ORAL FORM

THE beginnings of present-day study of oral expression may be traced to the middle of the nineteenth century, when attempts at recording the early speech of a child were made by several experimental psychologists.¹ The Child Study movement of the eighteen-nineties gave encouragement to such endeavours, and reports appeared at intervals in the first three decades of the twentieth century. Time-samples of varying extent were taken over periods of one hour, one day, one week, or one fortnight, and a considerable amount of information was collected. Its reliability, however, was low because of the difficulty of registering complete oral activity and the non-representative character of the children studied.

In recent years more scientific accuracy has become possible. Samples of children have been selected in such a way as to correspond in numbers to the proportions in various age-groups and occupational levels.² Comparable time-samplings have been used along with more refined statistical analysis of results. Mechanical means of recording sounds have also been devised³ and with their use a further increase in the reliability of results may be expected.

¹ For a summary of early studies see: Whipple, G. M., and Mrs. Whipple, "The Vocabulary of a Three-Year-Old Boy with some Interpretive Comments." *Pedagogical Seminary*, XVI. 1909. Starch, D., *Educational Psychology*. New York: The Macmillan Company. 1919; and more recently: Lewis, M. M., *Infant Speech*. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1936.

² McCarthy, D., *Language Development of the Pre-school Child*. Minneapolis: University of Minnesota. 1930. Day, E. J., "The Development of Language in Twins." *Child Development*, III. 1932. Davis, E. A., *The Development of Linguistic Skill in Twins, Singletons with Siblings and Only Children*. Minneapolis: University of Minnesota Press. 1937. See also: McCarthy, D., "Language Development in Children," in Carmichael L., et al., *Manual of Child Psychology*. New York: John Wiley & Sons Inc. 1946. *Studies in Reading*, I. The Scottish Council for Research in Education. London: University of London Press Ltd. 1948.

³ Betts, E. A., *An Evaluation of Certain Techniques for the Study of Oral Composition*. Iowa: University of Iowa. 1934.

As in the case of the learning activities of children in other school subjects, recent investigations of oral expression have been concerned with such topics as social usefulness, the errors made by pupils at various ages, the factors accompanying failure and the most satisfactory means of diagnosing difficulty and providing remedial exercises.

At the beginning of the twentieth century relatively little attention was paid in most schools to the development of fluent speech. In recent years, however, as part of the effort to adapt education more specifically to the needs of life, encouragement has been given to broadcast talks on speech training and to verse-speaking competitions; and new methods have been brought into the class-room.¹ In oral composition, as in written composition, there has been an advance from formal study to the provision of activities devised to make the desire for self-expression vivid to the pupils; and mere correction of errors has given place to the attempt to establish correct habits and to improve personal adjustments so that speech defects may be eliminated.

THE SOCIAL USES OF ORAL LANGUAGE

In daily life oral expression is much more frequent than expression in writing, and the efforts that have been made to record all the social uses of language have proved valuable as a reminder of the desirability of specific practice in such types of experience as informal conversation, group discussions; speech making, acting as chairman; the use of the telephone; interviews; directions, instructions, explanations; story-telling. Most of these activities are included in the ordinary background of children with wisely planned homes; but recent text-books for schools suggest means of bringing them within the experience of all pupils.

STUDIES IN ERROR

Analysis of the mistakes made by pupils has followed the same general lines as comparable studies of errors in written

¹ Cf. McAllister, A. H., *A Year's Course in Speech Training*. London: University of London Press Ltd. See also: Kinney, L., and Dresden K., *Better Learning Through Current Materials*. California: Stanford University Press, 1949. Higginbotham, P., "Leaderless Group Discussion," in Fleming, C.M. (ed), *Studies in the Social Psychology of Adolescence*. London: Routledge and Kegan Paul Ltd. 1951.

composition. The same types of difficulties have been found; but the lists of mistakes are not identical and there is considerable evidence to indicate that correct habits of written expression are not necessarily accompanied by correct habits of speech. More loosely constructed sentences and more run-on sentences occur in speech than in writing. Direct transference likewise does not occur from correctness in speech to correctness in writing.

THE DEVELOPMENT OF SPOKEN LANGUAGE

Study of the development of spoken language has been conducted in two main ways:

- (a) by an analysis of the vocabulary, sentence structure, and function of the language used by groups of children at different ages, and
- (b) by long-term studies of the speech of individual children.

The former method has gained in precision through the utilisation of modern techniques of research, while the latter has increased in thoroughness since the establishment in the last ten years of clinics for the prolonged study of child development.¹

The chief interest of both types of investigation has been their revelation of the amount of growth which takes place

¹ For a useful summary of much of this work see: *Pre-school and Parental Education*. Twenty-eighth Yearbook of the National Society for the Study of Education. Bloomington, Illinois: Public School Publishing Company. 1929; and McCarthy, D., "Language Development," in Murchison, C. (ed.), *A Handbook of Child Psychology*. Worcester, Mass.: Clark University Press. 1933. Trabue, M. R., et al., *Teaching Language in the Elementary School*. Forty-third Yearbook of the National Society for the Study of Education, Part II. Chicago: University of Chicago. 1944. McCarthy, D., "Language Development in Children," in Carmichael, L., et al., *Manual of Child Psychology*. New York: John Wiley & Sons Inc. 1946. Hefferman, H., "Readiness for Oral and Written Language," in Smith, N. B., et al., *Readiness for Reading and Related Language Arts*. The National Council of Teachers of English. 1950. Falk, E. M., "Vocabulary Readiness," in Smith, N. B., *Readiness for Reading and Related Language Arts*. The National Council of Teachers of English. 1950. A recent example of long-term study may be found in Gesell, A., *Biographies of Child Development*. London: Hamish Hamilton Medical Books. 1939. While an interesting discussion of the function of language from a point of view very different from that of McCarthy may be seen in Piaget, J., *The Language and Thought of the Child*. New York: Harcourt Brace & Co. 1926. Piaget, J., *Le Développement des Quantités chez l'Enfant*. Neuchatel: Delachaux & Niestlé S.A. 1941. Piaget, J., *La Formation du Symbole chez L'Enfant*. Neuchatel: Delachaux & Niestlé S.A. 1945.

before a child is old enough to go to school; and emphasis has been laid by both on the part played by the environment in stimulating development and in guiding the formation of correct habits of speech.

A sequence may be traced from the reflex sounds of infancy up to the emergence of true speech—through vocal grunts (which vary in timbre, pitch, and pattern), through vowel and consonant sounds, to the babbling repetition of syllables and the shouting for attention which seems to be the first socialised vocalisation. This in turn is followed by expressive tones and inflections, by comprehensible words, by the use of pronouns, and the employment of phrases and sentences.¹

The use of words as symbols appears to start between the eighth and the seventeenth months; but vocabulary usually increases very slowly for the first six months after this beginning. In the third and fourth years approximately six hundred new words seem to be added yearly and in the fifth and sixth years about five hundred new words appear.²

The development of language takes place partly by this addition of new responses and partly by the movement from a more general to a more precise understanding of the significance of each symbol. The learning of language, however, seems to proceed by wholes rather than by parts; and, after about two years of age, the proportions of different parts of speech are very similar to those observable at later ages. Practically every form of sentence structure has also under favourable conditions been employed by the age of five or six years; but there is later a steady increase in the length and complexity of responses and in the number of adverbial and adjectival clauses.³

¹ Cf. Shirley, M. M., *The First Two Years. A Study of Twenty-five Babies*. Minneapolis: University of Minnesota Press. 1933.

² See Smith, M. E., *An Investigation of the Development of the Sentence and the Extent of Vocabulary in Young Children*. Iowa: University of Iowa. 1926; and Williams, H. M., et al., *Development of Language and Vocabulary in Young Children*. Iowa: University of Iowa. 1937. See also: Kinney, L., and Dresden, K., *Better Learning through Current Materials*. California: Stanford University Press. 1949.

³ Cf. McCarthy, loc. cit., Day, loc. cit., Davis, loc. cit., Smith, loc. cit.; see also Boyd, W., "The Beginning of Syntactical Speech: A Study in Child Linguistics." *Child Study*, 6. 1913; and Boyd, W., "The Development of Sentence Structure in Childhood." *British Journal of Psychology*, XVII. 1926.

FACTORS ASSOCIATED WITH PROGRESS

Studies of language development have drawn attention to the amazing amount of practice received daily by children who have opportunities for social intercourse of a type that may be called normal.¹ They also indicate the adverse effect of broken home-life or of life in institutions, where such encouragement towards self-expression is lacking.

Even within families which are normal in other respects there is evidence to show that verbal facility is influenced by differences in environmental conditions. Only children have been reported to articulate better and to use a larger vocabulary than single children with brothers and sisters, and these in turn are said to be more advanced than twins at each age-level.

A similar effect of environment is shown in the differences revealed by the study of groups of children of comparable mental age and different socio-economic status. Retardation of from four to twelve months in sentence structure and vocabulary has been shown to exist among children of parents of different occupational levels.

INTELLIGENCE

Language development is also directly associated with the growth of intelligence. So much is this the case that vocabulary tests have been used to measure mental ability,² and studies of feeble-minded or of gifted children have shown great divergences from the normal, both in language content and in structure.³

HEALTH AND PERSONALITY ADJUSTMENT

A realisation of the part played by normal physical health and freedom from emotional upsets is one of the contributions made by case-studies of pupils with retarded speech develop-

¹ Cf. Brandenburg, G. C., "Psychological Aspects of Language." *Journal of Educational Psychology*, 9. 1918. Pear, T. H., *The Psychology of Conversation*. London: Thomas Nelson & Sons Ltd. 1939.

² Cf. Whipple, G. M., *Manual of Mental and Physical Tests*. Baltimore: Warwick and York Inc. 1910; and Terman, L. M., *The Measurement of Intelligence*. London: George G. Harrap & Co., Ltd. 1919. See also: Watts, A. F., *The Language and Mental Development of Children*. London: George G. Harrap & Co., Ltd. 1944.

³ See Terman, L. M., et al., *Genetic Studies of Genius*. California: Stanford University Press. 1925.

ment.¹ Language difficulties are often directly related to factors such as malnutrition, fatigue, defective vision, hearing, or dentition, diseased tonsils or adenoids, as well as to more obvious physical disabilities, such as malformations of the speech organs, birth injuries, and muscular or nervous weakness. Symptoms such as timidity, inability to listen, lack of interest, indistinctness of utterance, or undue tenseness may be relieved by attention to the general health of the child.

Unhappy home life, conditions of strain, lack of sympathy, over-indulgence, and prolongation of babyhood may all contribute to irregularity in development; and the imitation of faulty speech patterns may also be the cause of what appears to be a marked speech defect.

REMEDIAL TREATMENT AND DIAGNOSIS

Except for general attempts to increase interest in correct habits of speech and to widen the range of pupils' interests by providing a natural setting for varied uses of language, the chief remedial work in the field of speech has centred on marked forms of speech defect such as difficulties in articulation, disturbances in rhythm (stuttering or stammering) and failures in expression (aphasia).

There have been, of course, some discussions of choice of topic, selection of material, organisation of material, effect upon audiences, voice production, rate of speech, overt bodily activity, etc., but they have, for the most part, been suited to adult students interested in public speaking. The treatment of speech defects has, in recent years, progressed from a formal approach with an emphasis on physical accompaniments to an interpretation which postulates the need for sympathetic study of individuals and an effort to improve their adjustment to life as one of the most important steps towards a solution of the specific difficulties of their disability.²

¹ Cf. McAllister, A. H., *Clinical Studies in Speech Therapy*. London: University of London Press Ltd. 1937. Gilkinson, H., *Outlines of Research in General Speech*. Minneapolis: Burgess Publishing Co. 1943. Sheridan, M. D., *The Child's Hearing for Speech*. London: Methuen & Co., Ltd. 1948. Rossignol, L. J., *The Relationship Among Hearing Acuity, Speech Production and Reading Performance in Grades 1A, 1B, and 2A*. New York: Teachers' College, Columbia University. 1948.

² Cf. Travis, L. E., *Speech Pathology*. New York: D. Appleton & Company. 1931; and McAllister, loc. cit. See also: Hahn, E. F., *Stuttering: Significant Theories and Therapies*. California: Stanford University Press. 1943.

ARTICULATION

Diagnosis of defects in articulation is based mainly upon listening to a child's unemotional spontaneous speech; but some estimate is also needed of his understanding of spoken language, and tests may be given to measure his ability to pronounce and to use words containing consonant and vowel sounds.¹

Remedial work may be directed to the exercising of weak and relaxed muscles in tongue, lip, or soft palate. Direct practice in listening to a sound produced correctly by the teacher may be followed by attempts on the part of the pupil to imitate what he has heard. Efforts are best directed to the perfecting of one sound at a time. Attentive reproduction is essential; and the active interest and co-operation of the child are necessary.

STUTTERING

Studies of stutterers require very thorough investigation of the pupil's development history, both in relation to the onset of stuttering and to early retardation in other motor activities. Information as to the type of handedness and the amount of left-handedness in the family background is also of importance along with details of the family and personal history in physical, emotional, and mental health.

Treatment has to be based on a full consideration of all the evidence so obtained. The physical condition of the stutterer has to be made as perfect as possible through medical treatment, where necessary, and through a wise programme of sleep, exercise, and diet. His attitude to his disability has to be made objective. He has to attain insight into himself, his development, and his relationship to other pupils. He has to discover what particular situations cause him embarrassment; and he has to be freed as far as possible from fear and shame in relation to his difficulties.

(An older pupil may be led to an understanding of his handicap by writing an autobiographical account of his home, family, and personal history. This autobiography may then be used as a text-book with a view to discovering his attitudes

¹ See Travis, loc. cit. Spadino, E. J., *Writing and Laterality Characteristics of Stuttering Children*. New York: Teachers' College, Columbia University. 1941.

—social, emotional, and vocational. Some knowledge of the history of other stutterers is also useful.)

Practice in graded experiences of the type which cause him confusion is usually helpful, and a development of left-handedness may be desirable (if there is a history of confusion in handedness or of left-handedness suppressed in childhood).

Finally, the stutterer is helped by any devices or direction of interests which lead him to talk more and act more, and think and feel less about himself. Improved personal adjustment to life often carries with it an apparently spontaneous disappearance of his symptoms.

APHASIA

In the treatment of aphasia much depends on the history of the difficulty; but the first task of the teacher is again to improve the general adjustment of the pupil and to convince him that education is possible.¹

THE FINDINGS OF RESEARCH

1. There is need for specific training in oral expression. Correct habits are not necessarily transferred from written expression to oral language.

2. Activities involving oral expression are much more frequent in daily life than activities involving writing.

3. A large part of the development of spoken language normally occurs in pre-school years.

4. There is a marked improvement in vocabulary, articulation, and sentence structure with increasing age; but progress can be accelerated by deliberate speech training.

5. Language development is adversely affected by lack of encouragement towards speech, and it may vary with the position of a child in the family constellation.

6. There is a positive relation between socio-economic status and linguistic development.

7. Linguistic environment plays a large part in determining linguistic development. Remedial training should be directed to the attentive hearing and deliberate reproduction of correct patterns of speech. Children learn to speak and listen through practice in speaking and listening.

¹ Cf. Orton, S. T., *Reading, Writing and Speech Problems in Children*. London: Chapman & Hall Ltd. 1937.

8. Initiative and activity on the pupil's part are a necessary condition of progress. Materials for speech training should be within the range of the child's interests and level of maturity.

9. Correction of speech defect should be preceded by and accompanied by measures to improve the mental and physical health of the pupil.

RESEARCH NEEDED

Research is needed on the following topics:

The developmental history of effective and ineffective speakers with special reference to home background, ambitions, interests, attitudes, etc.

The relation of skill in communication of ideas to personal attributes and social maturity.

The effect of class-room criticism upon personal adjustment and mental health.

The contribution of leaderless group discussions to speech therapy.

The use of dramatising and related activities in the remedial treatment of speech difficulties.

The measurement of development in oral expression.

Class-room and home conditions as they affect the growth of ability to express ideas orally.

The use made of oral speech by pupils at various stages of their development.

The measurement of speech-comprehension at different ages.

The relation between language development and motor development.

The relative effectiveness of formal correction of errors and of extended practice in hearing and using correct forms.

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CHAPTER V

WRITTEN EXPRESSION

IN the last fifty years the teaching of expression in English has undergone modifications somewhat similar to those observable in the teaching of reading or of elementary mathematics. It seems reasonable to attribute these changes also—at least in part—to the change in outlook consequent upon some dissemination of the results of research.

At the beginning of the century, instruction in English usage was almost entirely limited to lessons on formal grammar. There was little realisation of the importance of training for self-expression, either in writing or in speech, and little understanding of the difficulties which pupils meet in their struggle towards the mastery of accepted forms of communication.

Recognition of the importance of written expression has come partly as a result of a changed interpretation of the function of the school and partly as a consequence of increased emphasis on silent reading and on the recording and summarising of information obtained in this way.

When it was realised that success in learning was proportionate to the activity of the learner it became important for the school to extend its range of experience. Reporting, summarising, story-telling, essay-writing, began to take a definite place in the curriculum, and, while at first these activities were of a formal type conducted and criticised on class lines,¹ the interest of investigators soon turned towards their measurement and control.

MEASUREMENT

As in the case of reading, earlier studies were concerned with the more mechanical aspects of the process. The first type of skill to be considered was that of spelling, but work on spelling was soon followed by experimental analysis of the movement of the hand in writing:

¹ An interesting anticipation of a more modern point of view is found in Hartog, P. J., *The Writing of English*. Oxford: Clarendon Press Ltd. 1908.

In both handwriting and spelling the evidence obtained from laboratory studies and from standardised tests led to marked changes in the practices adopted in the schools.

In the second decade of the twentieth century the attention of investigators turned to the direct measurement of written composition as a whole. Efforts were made to construct standardised scales.¹ These carried with them at first the assumption that essays were to be judged as wholes and that an inclusive mark could be given for content, style, structure, spelling, and writing. At a later date attention turned to a more analytic type of assessment in which attempts were made to reach agreement on such aspects of composition skill as thought, structure, and mechanics.²

The most important result of the surveys made by such means was the further evidence they provided of the wide range of individual differences,

(a) among examiners of equivalent experience,
and (b) among pupils of equivalent age or class.

The former led to recognition of the unreliability of essay-type examinations,³ and the latter to a more detailed analysis of the aims of teaching and to an attempt to discover the factors accompanying success or failure in written expression.

These studies in turn stimulated interest in the content of existing text-books and in methods of securing speedy elimina-

¹ These consisted of reproductions of representative specimens of children's work at different levels of success. See: Starch, D., *Educational Measurements*. New York: The Macmillan Company. 1916. Cf. Burt, C., *Mental and Scholastic Tests*. London: P. S. King & Son Ltd. 1921. See also: Buros, O. K., *Mental Measurements Yearbook*. New Brunswick: Rutgers University Press. 1938; and Buros, O. K., *The Nineteen-Forty Mental Measurements Yearbook*. Highland Park, New Jersey. 1941.

² Relevant British examples of such analyses may be found in: Perrie-Williams, E., *The Northamptonshire Composition Scale*. London: George G. Harrap & Co., Ltd. 1933; Steel, J. H., and Talman, J., *The Marking of English Compositions*. London: James Nisbet & Co., Ltd. 1936.

³ Cf. Hudelson, E., *English Composition: Its Aims, Methods, and Measurement*. Twenty-second Yearbook of the National Society for the Study of Education. Bloomington, Illinois: Public School Publishing Company. 1923. Boyd, W., *Measuring Devices in Composition, Spelling and Arithmetic*. London: George G. Harrap & Co., Ltd. 1924. See also among many others: Hartog, P., and Rhodes, E. C., *The Marks of Examiners*. London: Macmillan & Co., Ltd. 1936; and Hartog, P., *The Marking of English Essays*. London: Macmillan & Co., Ltd. 1941.

tions of pupils' errors. They also led to enquiries outside the schools as to the best contemporary usage and as to the uses to which written expression was put in the world of affairs.

Alongside this analysis (and ultimately merging with it) there have been investigations into the gradual development of power of expression. Studies have been conducted in vocabulary, phrasing, sentence structure, punctuation, and capitalisation; and a beginning has been made in the determining of what may be expected from pupils at different age-levels.

In both types of approach there are signs of rapidly increasing reliance on the evidence of actual investigation as opposed to theoretical exposition of objectives; and in both the danger of preoccupation with mechanical and technical aspects shows signs of replacement by an emphasis on the need for activity and interest on the part of the pupil accompanied by patience and a study of levels of maturity on the part of the teacher.

FORMAL GRAMMAR

At the end of the nineteenth century the chief preoccupation of teachers of English was the formal study of grammar. When justification was required for this it was given in terms of the value of grammar as a mental discipline. It was assumed that drill in grammatical analysis would result in improved ability to write and to recognise correct English. After psychologists began to experiment on school subjects doubt was cast on this transfer of training, and little more relationship seemed proved to exist between grammar and composition or grammar and interpretation than between such subjects as grammar and geography.¹

STUDIES OF SOCIAL USE

The failure of grammar to demonstrate its disciplinary value forced teachers of English to look elsewhere for a definition of their aims; and, as in the case of reading and of elementary mathematics, attention turned to the social uses of expression. Attempts were made to tabulate the specific types of training required by workers in various occupational

¹ See Lyman, R. L., *Summary of Investigations relating to Grammar, Language and Composition*. Chicago: University of Chicago. 1929.

groups and the actual frequency of written expression in the activities of ordinary life.¹

As a consequence of these discussions, less time is now given to the teaching of grammar; and the formal essay-writing and summarising which at first took its place is giving way to attempts to introduce activities which provide a reason for writing and which place each kind of written composition in a natural setting.²

An increasing realisation of the need of provision for individual differences, and the adoption of methods such as the Dalton Plan or the Project Method, have also incidentally increased the amount of practice in written composition; and the experience of many schools has gone to show that pupils learn to write through writing. The first tasks of the teacher of expression are therefore now generally admitted to be to put pupils into situations in which they have something to say and to provide them with a motive for desiring to say it.

STUDIES IN ERROR

Another line of approach to the determination of the proper aim of the teacher of expression is through a study of pupils' errors. As in the comparable development of the detailed analysis of skill in arithmetic, this type of investigation led to a realisation of the complexity of the process under review. The method was at first applied merely to collecting the most obvious breaches of grammatical correctness³; but with the opportunities of analysing comparable material which followed the widespread use of composition scales, the interest of investigators turned to more detailed recording of errors in sentence structure, capitalisation, and punctuation.⁴ (Analysis

¹ Cf. Johnson, R. I., *English Expressions: A Study in Curriculum Building*. Bloomington, Illinois: Public School Publishing Company. 1926.

² Cf. Lyman, R. L., *The Enrichment of the English Curriculum*. Chicago: University of Chicago. 1932.

³ Lyman, R. L., *Summary of Investigations relating to Grammar, Language and Composition*. Chicago: University of Chicago. 1929.

⁴ An index of difficulty based on eight studies of punctuation gave, for example, the ranking of items such as apostrophe, period at the end of a declarative sentence, comma with non-restrictive clause, insertion of unnecessary comma, comma with parenthetical expression, use of quotation marks, period for abbreviations, mark of interrogation. See: Smith, D. V., *Diagnosis of Difficulties in English*. Thirty-fourth Yearbook of the National Society for the Study of Education. Bloomington, Illinois: Public School Publishing Company. 1935.

of still larger masses of material is now being attempted by means of apparatus suitable for mechanical tabulation. It will be interesting to note the extent to which the use of such devices confirms the findings of less thorough analyses.)

Results of such analyses have not yet been produced under conditions sufficiently uniform to warrant curriculum modification on a large scale. (One of the difficulties of securing uniformity in discussions of lists of errors is, for example, traceable to the fact that standards of correct usage vary to some extent from one district to another, and that opinion is divided as to which innovations should be tolerated as signs of the natural evolution of a living language. Attempts have therefore recently been made to define canons of correct usage as these are accepted by British and American publishers, linguists, business men, and teachers.¹)

Lists even in their present form do, however, indicate the possibility of definite location of mechanical difficulties in sentence structure, phrasing, punctuation, and vocabulary. They also show that there is a limited range of errors in most class-rooms, that these errors recur at different ages, and that there is a consequent need for drill based upon a pupil's own type of mistake. They have led teachers to take two definite steps: (*a*) to attempt the diagnostic study of pupils who fall below their class-level in facility of expression; (*b*) to undertake experimentation with different types of remedial treatment.

CASE-STUDIES

One of the first advantages of a return to case-studies from large-scale analyses of errors is that the teacher is reminded that successful composition is more than mere avoidance of error. Letter-writing, note-taking, exposition, or argument may be free from mistakes in sentence structure and yet may be inadequate through lack of the power to understand, to organise, and to express ideas. They may be deficient also in balance, rhythm, and the effective use of words.

¹ Cf. Leonard, S. A., *Current English Usage*. Chicago: National Council of Teachers of English. 1932. From a somewhat different viewpoint see: Yule, G. V., *The Statistical Study of Literary Vocabulary*. Cambridge: At the University Press. 1944.

Little is yet known as to the factors which accompany success in written expression or as to the optimal mental age at which instruction should be attempted in different types of grammatical usage or punctuation. There is, however, evidence to suggest that growth in vocabulary is a concomitant of increasing mental age, and that the organising and expression of abstract ideas is beyond the power of pupils of low mental capacity.

Increase in effective expression is also dependent on general vitality and freedom from marked defects of physique. The social and environmental background of pupils plays a large part in determining the degree of facility to which they attain.¹ Children require a certain degree of security, encouragement, and the stimulation which results from personal activity and free access to books before they can achieve skill in the written expression of ideas. They need also a certain measure of success, and a home and school environment which induces interest in writing and provides adequate opportunity for regular practice and for the maintenance and development of skill.

STUDIES OF DEVELOPMENT OF ABILITY

In the last twenty years there has been a fusion of these two lines of investigation—that through error-counts and study of usage and that centring on the difficulties of individual pupils. There has been a marked increase in the number of studies of groups of pupils at different age-levels, and a body of information has been collected on the general development of expression in writing. This should ultimately prove of service in the determination of age-levels of performance and the consequent recognition of degrees of disability.

Growth of ability involves highly complex processes—development of vocabulary, increase in the range of ideas, acquisition of the art of handwriting and the habits of accepted style, usage, and grammar as well as familiarity with the rules of punctuation and capitalisation. It is therefore not surprising that measurable increments in skill are small when judged by synthetic composition scales and that many fluctuations of

¹ Cf. La Brant, L., *A Study of certain Language Developments of Children in Grades Four to Twelve*. Genetic Psychology Monographs. 1933.

ability occur even on the more analytic scales now offered for use in diagnosis.¹

Increasing complexity of thought also retards progress; and errors in simple types of sentence structure, in grammatical form, or even in spelling may reappear at age-levels at which they might have been expected to have been outgrown.

Overlapping of ability from age to age is great, and difficulties are so personal in type that individual instruction is necessary.²

Signs of developing maturity are reported to be: increase in sentence length and in the number of subordinate clauses, variety in word-order and in the choice of adjectives, and decline in ego-centricity.³

Along with these go increases in the number of marks of punctuation and in the correctness of capitalisation. There is, however, so much evidence of difficulty at each stage that the need for constant revision and continuous practice is evident.

REMEDIAL TREATMENT

Remedial treatment consists chiefly in such provision of practice under conditions of happiness and co-operative activity. Its expert direction may be assisted by use of the objective tests of competence in expression which are beginning to take the place of assessments through judgments based on essay-type examinations.

¹ For recent tests see: Buros, O. K., *Mental Measurements Yearbook*. New Brunswick: Rutgers University Press. 1938; and Buros, O. K., *The Nineteen-Forty Mental Measurements Yearbook*. Highland Park, New Jersey. 1941. Buros, O. K. (ed.), *The Third Mental Measurements Yearbook*. New Brunswick: Rutgers University Press. 1949. See also: Hamley, H. R., et al., *The Testing of Intelligence*. London: Evans Brothers Ltd. 1935; and Schonell, F. J., *Backwardness in the Basic Subjects*. Edinburgh: Oliver & Boyd Ltd. 1942. See also the tests in: Watts, A. F., *The Language and Mental Development of Children*. London: George G. Harrap & Co., Ltd. 1944. The results reported from their use with English children may profitably be compared with the American summary given in Trabue, M. R., et al., *Teaching Language in the Elementary School*. Forty-third Yearbook of the National Society for the Study of Education. Part II. Chicago: University of Chicago. 1944.

² Cf. Fleming, C. M., *Individual Work in Primary Schools*. London: George G. Harrap & Co., Ltd. 1934. See also: Pooley, R. C., *Teaching English Usage*. New York: D. Appleton-Century Company Inc. 1946.

³ Cf. La Brant, loc. cit.

Samples of such tests can be found in most books on attainment testing. An excellent discussion of the technique of their construction is given in a recent report published by the Qualifying Examination Board of the Corporation of Glasgow Education Department,¹ and specimens arranged as sub-tests may be found in the English Test for the Glasgow Qualifying Examination 1939, to which reference is made in that report. The advantage of such sub-tests is apparent through a study of the opportunities they afford of estimating relative levels of development in recognition of equivalences in sentence structure, in the use of prepositions, verbs, etc., in comprehension of vocabulary, or in ability to arrange ideas in order.²

Remedial instruction includes deliberate tuition directed to the elimination of the weaknesses revealed by such analytic tests. The ability to write is, however, fostered not merely by emphasis on formal correctness. Mastery of language is an accompaniment of growth in capacity for thinking. It is an index of stability and mental health and a reflection of the social environment in which a child is growing to maturity. Deficiencies in the home can, however, be counterbalanced by experiences in school, and, as has been indicated above, the opportunities for such stimulation have been greatly increased by acceptance in the last thirty years of the desirability of activity in the class-room.³

¹ *Report on the Testing of English Ability in Glasgow Pupils at the Qualifying Stage.* 1941.

² Cf. also Schonell, F. E., *Schonell Diagnostic English Tests.* Edinburgh: Oliver & Boyd Ltd. 1940; and, for a more functional use of analytic testing in story form: Fleming, C. M., *Cotswold Measurement of Ability in English.* Glasgow: Robert Gibson & Sons Ltd. 1946 and 1950. Incorporation of such diagnostic devices in a series of remedial exercises has not yet been as fully achieved in this field of English expression as in the comparable province of elementary mathematics. See, however: Steel, J. H., *An Introduction to the King's English.* London: James Nisbet & Co., Ltd. 1932, and Ridout R., *English Workbooks.* London: Ginn and Company. 1951.

³ Broening, A. M., et al., *Conducting Experiences in English.* New York: D. Appleton-Century Company Incorporated. 1939. *Language in General Education.* New York: D. Appleton-Century-Crofts, Inc. 1940. Hourd, M. L., "The Education of the Poetic Spirit." *A Study in Children's Expression in the English Lesson.* Melbourne: William Heinemann Ltd. 1949. See also: Richardson, J. E., "Group Methods of Teaching Composition," in Fleming, C.M. (ed.), *Studies in the Social Psychology of Adolescence.* London: Routledge and Kegan Paul Ltd. 1951.

Not the least of the advantages of the introduction of individualised methods has been the resultant discovery of the benefits of responsible co-operation in projects of greater or lesser definiteness—and these not merely in what can be described as English but in the content-subjects of history, geography, or science.

The activities of pupils in the enterprising class-rooms of the sixth decade of the twentieth century are proving themselves untrammelled by subject-boundaries—though these remain convenient subdivisions for the purposes of adult discussion.

THE FINDINGS OF RESEARCH

From all these lines of approach—error counts, studies of usage, case-studies, developmental analysis—a certain number of findings seem reasonably well established on objective grounds.

1. There is a very slow improvement of quality from year to year in composition as measured by any existing scale.

2. The range of ability in any one class (as at present organised) is wide. Individual methods of instruction are, therefore, necessary.

3. The average length of compositions increases rapidly from year to year.

4. Complexity of sentence structure increases with both mental and chronological age; but there is some evidence that it is more closely related to chronological than to mental age. Enrichment of experience reacts beneficially on written expression.

5. Weakness in use of verb forms accounts for most of the mistakes in usage.

6. Errors are found to occur on a relatively small number of items; but the actual type of mistakes varies from individual to individual.

7. Formal practice in essay-writing is less successful as a means of increasing facility in written expression than is experience in the active use of expression in natural settings.

8. Detailed correction of errors in essays is less effective than organised practice on exercises devised to overcome the errors.

9. Drills based upon pupils' own types of error are more effective than general drills.

10. Provision of self-correction and pupil-responsibility in the use of remedial exercises assist in eliminating errors.

11. Knowledge of progress also increases speed of improvement.

12. Text-books may, with advantage, be analysed from the point of view of gradation of difficulty and frequency of repetition of drill.

13. Individual interviews with pupils as to their reasons for making mistakes are a valuable means of improving methods of instruction. There is little transfer from knowledge of rules of punctuation, etc., to correct usage.

14. Performance in written composition is affected by physical and mental conditions and by emotional and social experiences.

15. Negative criticism with emphasis on errors is less useful than the provision of a wide variety of interesting practice. Improvement can often be effected by alteration of attitude or changes in the associated emotional experiences of the pupil.

Much still requires to be done; but the best teaching practice¹ has in the last fifty years travelled a long way from the purely formal approach to grammar and the excessive emphasis on correction of errors which once characterised school handling of this subject.

RESEARCH NEEDED

Research is still needed on such topics as:

The out-of-school use of written composition at various levels of development.

The best stages at which to teach various elements of punctuation, capitalisation, sentence structure, use of specific verbs, pronouns, prepositions, etc.

The frequency of use of various elements of punctuation, etc., in the writing activities of children at various age-levels.

The frequency of use of the same elements in relation to the number of errors made in each by individual children.

The relative difficulty of various items under controlled conditions of learning.

¹ Cf. Lyman, R. L., *The Enrichment of the English Curriculum*. Chicago: University of Chicago. 1932. See also *Handbook of Suggestions for the Consideration of Teachers and others concerned in the work of Public Elementary Schools*. London: His Majesty's Stationery Office. 1937.

The effect of correction of mistakes at various developmental levels.

The relationship between skill in expression and health and social adjustment.

The assessment of the more creative qualities of composition—originality, freshness, and interest.

The amount of test material necessary to secure adequate sampling.

Variations in performance from one occasion to another.

The value of oral drill as a means of improving written expression.

The relative effectiveness of individual as compared with group instruction.

The methods of study adopted by successful and unsuccessful pupils.

The consequences of differing methods of class-room organisation (size of groups, etc.).

The effects of differing forms of encouragement or rebuke.

The relative effectiveness of detailed correction of errors and assessment of general clarity of expression.

Motivation at various levels of skill.

Attitudes, interests, home background, etc., in relation to success and failure.

The developmental history of enthusiastic writers of prose or poetry.

The contribution of successful expression to personal adjustment and mental health.

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London: George G. Harrap & Co., Ltd. 1944.
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¹ For this and for subsequent chapters relevant summaries of research will be found for the most part in the same journals which report comparable findings in reading and in elementary mathematics. See pages 38 and 62 above. Information as to the titles of such journals is therefore not repeated. Research workers do well also to consult the publications of the Councils for Educational Research in this and in other countries, the Yearbooks of the National Society for the Study of Education (now issued from the University of Chicago Press), and the publications of Teachers' College, Columbia University, New York. All of these are accessible through university libraries in Great Britain.

CHAPTER VI

SPELLING

EXPERIMENTAL investigations into spelling have, in the last fifty years, taken two main directions:

- (a) an attempt to determine objectively which words children should be able to spell; and
- (b) an effort to discover the most effective and economical means of helping pupils to spell the desired words with confidence and accuracy.

Both lines of enquiry have led to findings which are of value to teachers.

THE CONTENT OF THE SPELLING CURRICULUM

Study of the content of the curriculum in spelling was one of the earliest outcomes of the movement towards greater social usefulness which marked the turn of the century. It attained clear expression in the work of Ayres, who assumed that spelling practice in school should deal with the most important words, and that their selection should be determined by counting, and not by the mere opinion of the teacher.¹ Research since 1914 has accepted these two assumptions, and has been directed to the clarifying of the issues involved.

Vocabulary studies in spelling have proceeded on lines analogous to those in the fields of reading and of speaking; and there has been similar progress in the extent of samplings, the selection of the sources, and the adequacy of the treatment of data.

Early investigations dealt with the vocabularies of a small number of individuals selected from a limited environment and dealing with a narrow range of subjects. Even in such circumstances, it was found that choice of words is dependent

¹ For an accessible account of early studies see Starch, D., *Educational Measurements*. New York: The Macmillan Company. 1916.

upon the activity in which the individual is engaged. The vocabulary used in speaking differs from that employed in writing; while neither is co-extensive with that which can be understood in listening or in reading. Considerable overlapping in the four vocabularies is admittedly present; but the identity is not sufficient to justify the nineteenth-century practice of basing spelling exercises on the vocabulary of the class reading-book or upon the oral vocabulary of the teacher.

Students of spelling, therefore, from an early date turned their attention to the vocabulary used in writing. This was investigated in the first place by attempts to discover which words were most frequently used in the written transactions of ordinary life.

In this search two lines of approach were employed:

- (a) analysis of the words used by adults;
- (b) a tabulation of the words found in the writing of children at different ages.

The former was expected to provide guidance as to the spelling skill which pupils would require after they had left school; and the latter was of interest as a means of deciding upon an optimum order of teaching for the words which it seemed most important for pupils to learn.

In both types of enquiry there has been a remarkable development in the extent and reliability of the data upon which recommendations can be made.¹

The earliest criterion employed in the case of adult writing was that of frequency; and the earliest material analysed was that of personal and business letters. It was soon realised, however, that it is difficult to obtain adequate samples of certain types of personal letters and of business records. Selection on the basis of mere frequency can hardly be made representative. The usefulness of words for spelling instruction is also in reality determined by other criteria than that of frequency alone. Attempts were accordingly made to evaluate words on grounds such as the universality of their use (regardless of educational level, economic status, or geo-

¹ Cf. Horn, E., *A Basic Writing Vocabulary*. Iowa: University of Iowa. 1926. In this a tabulation of more than 5,000,000 words yielded a total of more than 36,000 different words and a list with weighted frequency credits for 10,000 words.

graphical position), their commonness in different types of writing, the severity of the social penalty attached to their misuse, their probable permanence, and the style of writing in which they most often appear.¹ Using criteria of this kind, it was found that there is a common core of four or five thousand words which are used as a writing vocabulary by the great majority of adults regardless of educational level, occupation, status, sex, or geographical locality. This basic list is also, with few exceptions, duplicated in the Thorndike list of the first ten thousand words of greatest frequency in reading material²; and it is paralleled by words found in comparable vocabulary counts in other languages. It seems, therefore, reasonable to believe that these words provide a guide as to the ultimate (minimum) spelling needs of pupils by the time they leave the ordinary school.

The question which next arises is as to the order in which these words should be learnt. Attempts have been made to answer this by an analysis of words actually used by pupils, (a) in essays written in school, (b) in letters written outside of school, and (c) in other activities involving written expression.³

From these studies it appears that there is very considerable overlapping at each age between the words used by children and by adults, and that the vocabulary needs of pupils are wider than was at first assumed from an analysis of the words used by them in formal essay-writing. The vocabulary employed by a child on a topic which arouses interest differs

¹ Cf. Horn, loc. cit. It is of interest to remember that a similar abandonment of the criterion of mere frequency is found in the history of basic reading vocabularies. See Gates, A. I., *A Reading Vocabulary for the Primary Grades*. New York: Teachers' College, Columbia University. 1926. Cf. *Interim Report on Vocabulary Selection for the Teaching of English as a Foreign Language*. London: P. S. King & Son Ltd. 1936.

² Cf. Thorndike, E. L., *The Teachers' Word-Book*. New York: Teachers' College, Columbia University. 1921. Thorndike, E. L., and Lorge, I., *The Teacher's Word Book of 30,000 Words*. New York: Teachers' College, Columbia University. 1944.

³ For an accessible account of recent investigations see: Horn, E., and McKee, P., *The Development of Ability in Spelling*. Thirty-eighth Yearbook of the National Society for the Study of Education. Bloomington, Illinois: Public School Publishing Company. 1939. See also: McKee, P., *Language in the Elementary School: Composition, Spelling and Writing*. Boston: Houghton Mifflin Company. 1934.

significantly from that used in more artificial composition exercises. It seems probable that, when training in expression becomes more meaningful, the range of words needed by pupils will become still wider. At present, however, it is possible to assess, with fair accuracy, about three thousand words, which are of great importance in the writing of both children and adults. In addition, there are smaller groups of words used (*a*) by children chiefly, and (*b*) by adults for business purposes.

Sufficient information has not yet been collected to permit differentiation of all these words according to the age at which they are most likely to be required. The experiences of pupils vary; and development in writing vocabulary is very dependent upon richness of environment and extension of interests. A certain amount of evidence is, however, available as to the words which present difficulties at various ages,¹ and as to types of spelling errors occurring at different levels.² These studies offer some guidance to teachers who wish to supplement the functional use of spelling through active interest in correct expression with sets of graded test material on which to base deliberate study of words which prove to be mis-spelled.

METHODS OF WORKING

Studies of errors have been utilised to assist in the diagnosis of individual difficulties in spelling in a fashion similar to that of process-analysis in arithmetic. Attempts have been made to classify mistakes, (*a*) according to the types of alteration made in the shape of a word, and (*b*) according to the abilities associated with its successful spelling. The first of these lines of study, while productive of much enthusiastic controversy,

¹ For pupils in Great Britain some data may be found in: Boyd, W., *The Standard Spelling List* and *The Longer Standard Spelling List*. London: George G. Harrap & Co., Ltd. 1926; and Schonell, F. J., *The Essential Spelling List*. London: Macmillan & Co., Ltd. 1932. For American schools: Ayres, L. P., *A Measuring Scale for Ability in Spelling*. New York: Russell Sage Foundation. 1915; and Ashbaugh, E. J., *Iowa Spelling Scales*. Iowa: University of Iowa. 1919.

² Cf. Hollingworth, L. S., *Special Talents and Defects: Their Significance for Education*. New York: The Macmillan Company. 1923. Book, W. F., and Harter, R. S., "Mistakes which Pupils Make in Spelling." *Journal of Educational Research*, XIX. 1929.

has remained at a somewhat subjective level, and has yielded little direct assistance to teachers whose chief concern is the helping of individual pupils. There may be a certain academic interest in learning that mistakes in "known" words can be arranged under headings such as: omission, anticipation, transposition, interference, substitution; and that errors in "unknown" words may be classified as: alternatives, doublings, homonyms, mispronunciations, non-doublings.¹ The correctness of the grouping is, however, open to debate; and the allocation of the error to a particular group does not bring a teacher perceptibly nearer to the application of suitable remedial measures to the pupil whose mistake is under consideration.

The second line of approach has been somewhat more fruitful, since it has brought research on the subject of spelling into line with other studies on the processes involved in learning.² There is evidence, for example, that successful learning is related to span of apprehension, perception of word-forms, knowledge of meaning, ability to generalise phonetic units, rote memory, and ability to write accurately; and that the rapid acquisition of skill is linked with a desire to spell and a willingness to give time to attentive practice on the specific difficulties met with by the individual learner. When modern statistical techniques are more energetically applied to the study of spelling, it should become possible to determine with increasing accuracy the exact nature of the abilities involved.

The ability to spell is almost always measured by competence in writing. Transference from oral spelling to written spelling is, however, by no means certain. Training should therefore be given in seeing the word accurately, pronouncing it correctly, associating the sound of the syllables with their proper spelling, and writing the word from memory with care and accuracy. Transcription of the word is useful in the initial stages of this process; but it is no substitute for deliberate

¹ Cf. Book, W. F., and Harter, R. S., loc. cit.

² Cf. Williamson, E. G., "Mental Abilities related to Learning to Spell." *Psychological Bulletin*, 30. 1933. See also: Horn, E., *Principles of Method in Teaching Spelling as Derived from Scientific Investigation*. Eighteenth Yearbook of the National Society for the Study of Education. Part II. Bloomington, Illinois: Public School Publishing Company. 1919.

practice in spelling the word from memory followed by careful comparison with the correct spelling, as shown in a dictionary or a reading-book.¹

CASE-STUDIES

Interest in types of mistakes and investigations of the content of vocabularies of adults and children have occupied the energy of research workers in the field of spelling, somewhat to the exclusion of experimental study of the factors associated with failure. There are fewer records of case-studies in spelling than in reading, arithmetic, or speech; and there has been less consideration of the relationship of spelling ability to variations in intelligence, social status, and physical or mental health.²

There is, however, evidence that correlations with general intelligence are quite high, and that brighter pupils have a greater tendency to generalise.³ Weakness may be associated with sensory defects of the eye or the ear. Temperamental maladjustments may also be the cause of failure. Growth in ability is related to growth in experience and certain cases of mis-spellings may be interpreted in terms of hidden conflicts.⁴

While it is difficult to prove that spelling efficiency is related to differences in the pleasant or unpleasant connotations of words,⁵ there is little doubt that spelling, like other activities of the organism, suffers with any impairment of physical or mental stability.

¹ For a method based upon these requirements see: Fleming, C. M., *Individual Work in Primary Schools*. London: George G. Harrap & Co., Ltd. 1934.

² Earlier studies of this type are: Gates, A. I., *The Psychology of Reading and Spelling with Special Reference to Disability*. New York: Teachers' College, Columbia University. 1922. Hollingworth, L. S., *Special Talents and Defects: Their Significance for Education*. New York: The Macmillan Company. 1923. More recent work is exemplified by: Schonell, F. J., "The Relation between Defective Speech and Disability in Spelling." *British Journal of Educational Psychology*, 4. 1934. Schonell, F. J., "Ability and Disability in Spelling Amongst Educated Adults." *British Journal of Educational Psychology*, 6. 1936.

³ Cf. Carroll, H. A., "The Effect of Intelligence upon Phonetic Generalisation." *Journal of Applied Psychology*, 15. 1931.

⁴ Cf. Ulrich, C. F., "Interpretation of a Case of Mis-Writing." *Psychoanalytic Review*, 19. 1932.

⁵ Cf. Frandsen, A., "The Role of Affective Tone in Learning to Spell." *Journal of Educational Psychology*, 23. 1932.

MEASUREMENT

In the case of spelling there has been less development in the technique of testing than has occurred in the comparable subjects of reading or of arithmetic.¹

Spelling tests have remained at the original level of survey tests, and, while a beginning has been made in classifying errors according to weaknesses in visual or auditory analysis or in articulatory or writing accuracy,² there has been little progress in the construction of diagnostic tests associated with teaching programmes. Learning in spelling is so specific in its effects that achievement in a given time cannot fairly be measured by a standardised test whose items are necessarily fixed and may or may not have been included in the range of words studied.

Spelling tests, therefore, continue to be useful as rough measures of general ability in spelling rather than as guides to the exact remedial tuition required. Information as to the practice which each pupil needs has to be obtained from an

¹ The chief methods employed have been those of dictation and of correction or recognition of mis-spelled words. The former may be free as in: Burt, C., *Mental and Scholastic Tests*. London: P. S. King & Son Ltd. 1921. It may be partly controlled by the reading of a sentence embodying the word as in: *Sixteen Spelling Scales Standardised in Sentences for Secondary Schools*. New York: Teachers' College, Columbia University. 1921. Morrison, J. C., and McCall, W. A., *Morrison-McCall Spelling Scale*. New York: World Book Company. 1923. *Spelling Tests*. Melbourne: Australian Council for Educational Research. 1936. Alternatively it may be controlled by the provision on the test paper of a sentence into which the dictated word is to be written as in: Fleming, C. M., *Kelvin Measurement of Ability in Spelling*. Glasgow: Robert Gibson & Sons Ltd. 1932. Ability to recognise which spelling is correct is measured in tests such as: Burt, C., *Northumberland Standardised Tests*. London: University of London Press Ltd. 1925. Alexander, W. P., *Thanet Mental Tests*. London: University of London Press Ltd. 1937. This method of testing is to be deprecated on account of the undesirability of the study of incorrect spellings which it involves. A more recent method consisting of the presentation of sentences containing incomplete words to be completed by discovery of the missing portion and transcription of the whole word is exemplified in: Thomson, G. H., *Moray House Tests*. London: University of London Press Ltd. 1941. A more functional use of the same method in story-form is found in: Fleming, C. M., *Cotswold Measurement of Ability in English*. Glasgow: Robert Gibson & Sons Ltd. 1946.

² Cf. Mendenhall, J. E., *An Analysis of Spelling Errors*. New York: Teachers' College, Columbia University. 1930. See also: Schonell, F. J., *Essentials in Teaching and Testing Spelling*. London: Macmillan & Co., Ltd. 1932.

analysis of the actual errors which he makes in routine tests and in other writing activities. In most cases pupils are more speedily helped by learning a technique for self-teaching and by developing a "spelling conscience" than by laborious efforts on the part of the teacher to differentiate the type of imagery or sensory discrimination in which weakness may be detected.

The aims of the modern teacher of spelling have widened from the provision of mere class-drill on words which may be mis-spelled by some member of the group to the attempt to enlist the interest of the pupil in the discovery and correction of his own spelling errors. It is no longer considered sufficient to correct mistakes after they have been made; but training is given with a view to equipping the pupil with a method of working which will enable him to study new words. An effort is also made to provide him with experiences sufficiently varied and stimulating to promote the use and understanding of a constantly increasing vocabulary. In spelling, as much as in any other subject, progress is related to the insight, the skill, and the enthusiasm of the teacher, and success is closely connected with the widening experience, mental health, and stability of the pupil.

THE FINDINGS OF RESEARCH

1. There is considerable reliability of evidence on the basic spelling vocabulary corresponding to the four or five thousand words most needed by adults.

2. The writing vocabulary of children is larger than has commonly been assumed.

3. It overlaps considerably with that of the writing needs of adults.

4. Vocabulary differs significantly with the interest of the topic and with its suitability to the writer.

5. Study of words in which failure has already occurred is a more economical method of working than indiscriminate study of words in a spelling list.

6. Individual study of words is more beneficial than class methods of learning. A relatively small number of words is responsible for most mistakes.

7. Provision for independent study is best made by the teaching of a definite method of self-tuition.

8. The original presentation of a word should be as nearly as possible in the form in which it appears in its context.

9. Marking of hard spots is more of a hindrance than a help, since difficulties vary for different pupils.

10. The meaning of words should be studied in connection with the learning of their spelling; and training in the use of a dictionary is a distinct help in accelerating progress.

11. Many distributed repetitions are necessary for mastery; but learning, once achieved, is very lasting in its effects.

12. Instruction should be directed towards the development of an ardent desire to spell correctly, and incentives should be provided for the carry-over of correct spelling from spelling tests to all the written activities of the pupil.

13. Provision for self-correction and for recording of progress is of value in developing interest in correct spelling.

14. The formal study of spelling is best postponed until a pupil is sufficiently familiar with words to be able to analyse words into syllables—both auditory and visual. Certain studies seem to indicate that this degree of maturity is normally attained at about the mental age of nine.

15. Correlation of spelling ability with intelligence is quite high, and, where marked weakness occurs in pupils above 80 I.Q., special investigations should be undertaken into possible sensory defects, faulty habits of work, or personality maladjustments.

RESEARCH NEEDED

Research is still needed on the following topics:

Further investigations into the most important words, and more adequate samplings of the writing vocabulary of children at each age.

Determination of words to be studied at each age, and of a suitable order of presentation within each age-group.

Discovery of the words whose study can be omitted because (a) they are very easy, or (b) they are learnt incidentally in other subjects.

Determination of the difficulty of words before and after systematic teaching of a definite type.

Information as to the comprehension of words by pupils at different ages.

The influence of topics upon vocabulary.

The study habits of successful spellers and the factors accompanying success.

Diagnostic tests of spelling disability.

Statistical analysis of results of testing spelling ability.

The developmental history of successful and unsuccessful spellers with special reference to family attitudes, wishes, ambitions, home life, etc.

The effect of differing types of class-room organisation (grouping) and differing teacher-pupil relationships.

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CHAPTER VII

HANDWRITING

HANDWRITING is a form of manual dexterity and its acquisition and development proceed in a fashion comparable to that of the learning and maturing of other forms of motor activity. The study of skill in writing therefore falls into its proper place when it is considered as an offshoot, in the first instance, of the investigations into speed and accuracy of movement, steadiness, and reaction-time which occupied experimental psychologists in the middle of last century.

The most notable contribution of the twentieth century to its analysis is probably the recognition of the part played by the maturation of the organism as contrasted with the part played by deliberate training. Nineteenth-century workers were interested in recording, from year to year, differences in speed, accuracy, or steadiness. Nineteenth-century teachers believed in the importance of rigidly conventional, carefully supervised practice. Twentieth-century psychologists have made some attempt to estimate the untaught development of the organism to higher maturational levels. Twentieth-century teachers are asking questions as to the optimal age for beginning and ending instruction in writing.

This change in point of view may reasonably be claimed to be a consequence of the application of the findings of research to the study of handwriting and to its teaching.

EXPERIMENTAL STUDY

Writing has been investigated experimentally from two main points of view:

- (a) from that of the effect of various styles of handwriting upon posture, eyesight, and health;
- (b) from that of the influences of different types of movement upon speed, legibility, and economy of effort.

The former type of investigation led to decreased insistence on certain conventional postures in the learning of writing

and to alterations in the equipment and lighting of class-rooms. (The introduction of blackboard writing for pupils, the use of crayons, or soft lead pencils, and the encouragement of a larger style for beginners may be traced to the influence of this movement.) The latter type of study attained clear expression in the experimental work of Judd and later of Freeman¹; and it has been continued in investigations which utilise laboratory techniques similar to those used in observations on legibility and eye-movements in reading. The material so collected has been subjected to close examination and some evidence has been obtained as to the comparative legibility and ease of construction of certain letter forms.²

MEASUREMENT

Contemporary with this development of laboratory experiment a beginning was made with the standardised testing of children's handwriting in school. This was attempted by the use of "scales," consisting of representative samples of pupils' performances at different ages.³ The publication of these scales drew the attention of teachers to the importance of analytic study of such factors as uniformity of slant, uniformity of alignment, quality of line, letter formation, spacing of lines, words, or letters, size of writing, heaviness or neatness.

This analysis led in turn to a study of the type of error most prevalent at different ages, the characteristics of normal adult performance in various occupational levels, and the changes occurring in the ordinary development of skill.

¹ Cf. Judd, C. H., *Genetic Psychology for Teachers*. New York: D. Appleton Company. 1903. Freeman, F. N., *The Handwriting Movement: A Study of the Motor Factors of Excellence in Penmanship*. Chicago: University of Chicago. 1918.

² Cf. Boraas, H. O., "An Experimental Study of the Relative Merits of Certain Written Letter Forms with respect to Legibility, with Speed and Stability as Related Factors." *Journal of Experimental Education*, 5. 1936.

³ See: Thorndike, E. L., *Handwriting*. Teachers' College Record, II. New York: Columbia University. 1910. Ayres, L. P., *A Scale for Measuring the Quality of Handwriting of School Children*. New York: Russell Sage Foundation. 1915. Freeman, F. N., *Freeman Chart for Diagnosing Faults in Handwriting*. Boston: Houghton Mifflin Company. 1914. Specimen charts can also be seen in such books as: Starch, D., *Educational Measurements*. New York: The Macmillan Company. 1916. Burt, C., *Mental and Scholastic Tests*. London: P. S. King & Son Ltd. 1921; and Ballard, P. B., *The New Examiner*. London: Hodder & Stoughton Ltd. 1923.

The construction of handwriting scales also made it possible to compare by experimental studies in the class-room the relative merits of different methods of teaching and different styles of writing. A beginning, for example, has been made in the study of script writing as opposed to cursive writing. There is evidence that script writing (composed largely of straight lines and angular connections) is more easily learnt by young children and that they attain better results with it both in speed and in quality. It is also useful as a means of facilitating progress in reading and in spelling. With older pupils there are, however, indications that the more continuous movements of cursive writing, with its elimination of separate strokes, is less exhausting and, at equal speeds, no more illegible.¹

STUDIES OF DEVELOPMENT

Other comparable topics, on which, however, little work has yet been done, are those of writing-readiness and of writing-maturity. It is not yet known what are the best means of detecting a pupil's readiness to begin to learn to write. Current practice encourages an attempt at the infant-room stage (and there have been many theoretical discussions as to the type of unit with which beginning should be made). Experimental evidence on these points is still awaited. There is need also for investigations into the desirability of stopping formal instruction at about the age of twelve when the quality of handwriting reached by many pupils is similar to that of average adults as measured by a handwriting scale. The speed attained by most twelve-year-old pupils is, however, below that which is needed by the requirements of secondary education, and their performance also lacks the uniformity and continuity of a mature form of skill. To what extent further tuition is necessary at this stage is, as yet, a matter for conjecture.

Studies of the development of skill in handwriting show that, like the maturing of other forms of manual dexterity, the

¹ Cf. Voorhis, T. G., *The Relative Merits of Cursive and Manuscript Writing*. New York: Teachers' College, Columbia University. 1931. Brief historical notes on script writing will also be found in: Ballard, P. B., *The Changing School*. London: University of London Press Ltd. 1925. See also: Varty, J. W., *Manuscript Writing and Spelling*. New York: Teachers' College, Columbia University. 1938.

process is a slow one. The activity to be performed is complex—involving co-ordination of visual and kinaesthetic movements. Children's writing movements are more irregular and variable than those of adults; but with increasing age there is an increase in uniformity of pressure and of speed in the formation of each stroke. There is also an increase in continuity. Letters or words become more nearly the products of one movement and the length of the pauses between strokes is reduced. There is a similar development in regularity of rhythm. Successive units are written in more nearly equal periods of time. Maturity of form is to a large extent the product of these factors; and their relative preponderance varies in different individuals.

In handwriting, as in other forms of scholastic performance, the development of standardised tests has extended the possibilities of diagnosis and has made self-correction and remedial tuition more available as instruments for the use of the teacher.¹ Knowledge of progress as revealed by periodic testing has proved a valuable incentive to effort; and case-studies of pupils with marked disabilities have revealed the importance of personal adjustment and of physical and mental health on the part of the pupil. Writing is an activity of the whole organism; and without happy direction of attitudes and willing co-operation little permanent progress can be made.

This fact that writing is an expression of the whole personality has been re-emphasised lately by graphologists, who (accepting the thesis of the clinicians that regular and pleasantly patterned handwriting is produced by individuals with sound health and good personal adjustments) maintain² that the relation between writing and character may be inferred from a study of handwriting, and that maturation of personality can be described after a study of specimens obtained at definite time intervals.

Another line of recent study which promises to give fruitful results is that which tries to estimate the degree of

¹ Cf. Nystrom, E. C., *Nystrom Self-Corrective Handwriting Charts*. Minneapolis: Farnham Press. (n.d.).

² For a recent study of this topic see: Jacoby, H. J., *Analysis of Handwriting*. London: George Allen & Unwin Ltd. 1939. Cf. also: Allport, G. W., and Vernon, P. E., *Studies in Expressive Movement*. New York: The Macmillan Company. 1933.

handicap which the mechanics of writing impose upon the expression of ideas. Attempts have been made to escape from the limitations of partially acquired manual dexterity by permitting pupils to dictate their self-expression, to read it aloud, or to record it by the use of a typewriter. There is some evidence that the use of the latter medium leads to increased freedom and flexibility of expression.¹

Through some such separation of the difficulties due to the mechanics of writing and those traceable to a lack of ideas or an unwillingness to attempt expression, it should be possible to raise to a higher level of success the efforts that are at present being made to help pupils in the art of written composition.

THE FINDINGS OF RESEARCH

1. Handwriting skill is complex and it develops slowly in a fashion comparable to the development of other forms of manual dexterity.

2. With increasing maturity, handwriting movements gain in uniformity of pressure and of speed.

3. They also gain in actual rate and in continuity and in regularity of rhythm.

4. There is some evidence to show that the use of script writing in the first two years makes the learning of writing more easy.

5. Non-mastery of the mechanics of writing has a limiting effect on the amount and the content of the written composition of school children.

6. Provision for self-correction and knowledge of progress through the use of standardised tests are an aid to the development of skill in writing.

7. Deliberate acceptance of a high ideal in penmanship plays some part in determining style.

8. Personal adjustment and mental health are important precursors of good handwriting.

RESEARCH NEEDED

Investigations are required on the following subjects:

The relative merits of script and cursive writing at different ages.

¹ Cf. Haefner, R. W., *The Typewriter in the Primary and Intermediate Grades*. New York: The Macmillan Company. 1932.

The best letter forms for legibility, speed, and stability of form.

The deviations from conventional forms found in the handwriting (*a*) of children, (*b*) of adults.

The value of the rigidly conventional forms commonly taught in schools.

The optimal age for beginning writing (*a*) by right-handed, (*b*) by left-handed children.

The respective merits of emphasis on speed and on legibility at various ages.

The level at which handwriting becomes sufficiently automatic to cease to inhibit a child's desire for self-expression in written composition.

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CHAPTER VIII

HISTORY

THE influence of research upon methods and content has been less specific in the teaching of history than in the teaching of subjects such as spelling or arithmetic. There have, however, in the last fifty years, been certain very definite changes in attitude and in aim; and it seems reasonable to attribute these in part to the effect of investigations into the psychology of learning. A realisation of the importance of activity and co-operation has, for example, led to modifications of method. Analysis of social usage and attempts to determine minimum essentials have resulted in simplification of the content of text-books; and the development of testing has led through an emphasis on facts to an evaluation of attitudes, allegiances, and skills. History-teaching is much wider in its range and more conscious of its limitations than it was a generation ago. While to some extent the changes are traceable to an increased interest in international affairs and a quickening of social conscience, there is reason to believe that the patient studies of research workers have played their part in determining the direction of the modifications that have occurred.

MODIFICATIONS OF METHOD

History differs from most other subjects in that there is no direct contact on the part of pupils with the original experience which is the subject of their study. Much of the material of history consists of past politics, past geography, past sociology, past economics—records of past development in all kinds of human activities. The pupil's learning of these things is essentially vicarious; and the range of possible subject-matter is so wide that there is little agreement among teachers as to specific aims or a definite body of knowledge.

In general it may be said that in the last fifty years there has been in history (and in the kindred subject of geography) a change from passivity to activity on the part of the pupils. This change was foreshadowed in the latter part of the

nineteenth century by emphasis on the importance of active co-operation in learning; but it has been reinforced by the popularising of definite methods such as the Dalton Plan or the Project Method, and by the encouragement of discussion and of dramatising. Experimental evidence of the efficacy of such methods is rarely conclusive because of the specific character of the success of any one experiment and because of its dependence on imponderable factors, such as relationships between pupils and teachers. There is, however, a sufficient body of recorded opinion to testify to the general success of the methods.

Some decades ago the imparting of vicarious experience was attempted only through narrative, and the favourite method employed was lecturing, with a limited amount of reading of one text-book. With the development of interest in silent reading a change has taken place; and research has proved the efficacy of extensive reading, of written answers to questions, and of the summarising of material taken from different sources.

Parallel to this has gone an attempt to clarify historical learning by subdividing its content into definite units or topics to the study of which complementary subjects such as geography or English can contribute. (At more junior stages the same end has been attained by choosing centres of interest, such as transport or housing, and grouping all activities round these.)¹

This type of analysis and unification, while not new, has certainly increased in popularity, and the same can be said of the greatly extended use of visual aids, such as pictures, charts, pupils' note-books, graphs, and, more recently, of films.

¹ The tracing of such units through the centuries is defended in: Jeffreys, M. V. C., *History in Schools: The Study of Development*. London: Sir Isaac Pitman & Sons Ltd. 1939. Emphasis on the importance of activities and of co-operation with teachers of other subjects may be found in such English books as: Happold, F. C., *Citizens in the Making*. London: Christophers. 1935; and various publications of the Association for Education in Citizenship. See: *Education for Citizenship in the Secondary School*. London: Oxford University Press. 1935; and *Education for Citizenship in the Elementary School*. London: Oxford University Press. 1939. A useful bibliography is published under the title: *A Guide to the Teaching of History in Schools*. (A. C. F. Beales.) London: University of London Press Ltd. 1937. See also: Fleming, C. M., *Individual Work in Primary Schools*. Chapter V. The Project Method. Chapter XV. History and Geography. London: George G. Harrap & Co., Ltd. 1934.

The teacher of history makes much more use of such equipment to-day than he did a generation ago; and while some of the prodigality of supply is attributable to the increased frequency of pictorial appeal in newspapers and advertisements, its utilisation in the class-room is part of the effort to secure more activity from the pupil and more interest in the process of learning.

Its consequences, in the case of films, have been shown to be that voluntary reading is encouraged, and that retention is strengthened. There seems also reason to believe that duller pupils are stimulated even more than brighter pupils and that abstract ideas and remote events can be made more comprehensible at earlier ages with the aid of films.¹

Another recent addition to the means at a teacher's disposal for increasing the range of historical understanding is that provided by broadcasting. Experimental evidence as to its usefulness is more limited than in the case of films. There seems reason, however, to believe that wireless talks are helpful when used in conjunction with other forms of teaching, in spite of the relatively large number of erroneous ideas and the small degree of retention which may follow their employment when they are not reinforced by visual aids.² Where

¹ For a useful summary of experimental findings see: *Report on History Teaching Films*. London: British Film Institute. 1937. See also: Consitt, F., *The Value of Films in History Teaching*. London: G. Bell & Sons Ltd. 1931; and Horn, E., *Methods of Instructions in the Social Studies*. New York: Charles Scribner's Sons. 1937. Films are also a potent means of influencing attitudes. Cf. Peterson, R. C., and Thurstone, L. L., *Motion Pictures and the Social Attitudes of Children*. New York: The Macmillan Company. 1933. Dale, E., et al., *Motion Pictures in Education*. A summary of the literature. New York: The H. W. Wilson Company. 1938. Stenius, A. C., "Auditory and Visual Education." *Review of Educational Research*, XV, 3. June 1945. Pp. 243-55. Corey, S. M., et al., *Audio-Visual Materials of Instruction*. Forty-eighth Yearbook of the National Society for the Study of Education. Part I. Chicago: University of Chicago Press. 1949. Kinney, L., and Dresden, K., *Better Learning Through Current Materials*. California: Stanford University Press. 1949. McKown, H. C., and Roberts, A. B., *Audio-Visual Aids to Instruction*. New York: McGraw-Hill Book Company Inc., 1949. Svenson, E. V., and Sheats, P. H., "Audio-Visual Aids in Adult Education." *Review of Educational Research*, XX, 3. June 1950. Pp. 216-23. DeBoer, J. J., et al., *Education and the Mass Media of Communication*. The National Council of Teachers of English. 1950.

² Cf. Lumley, F. L., *Measurement in Radio*. Columbus: Ohio State University. 1934.

school broadcasting is, however, accompanied, as it often is, by skilfully prepared pamphlets, it proves a valuable device for stimulating interests.¹

ANALYSIS OF SOCIAL USAGE

Since about 1910, in history as in other subjects, there have been many studies of the content of the curriculum from two points of view:

- (a) an analysis of the knowledge, attitudes, or skills utilised by the normal adult community;
- (b) an enquiry into the vocabulary, the concepts, and the behaviour which are within the reach of pupils and therefore interesting to them at various stages of development.

Interpretation of the results of both types of analysis is necessarily open to the charge of some subjective bias. Deliberate selection has been made of the groups to be tested, the printed materials to be studied, and the criteria of satisfactory knowledge or sufficient skill. (There are also the further complications that "socially useful" information changes from time to time and from place to place with alterations in international relationships; and that, as in the case of vocabulary studies, mere frequency of usage cannot be accepted as the only acceptable criterion. Decisions as to the content of courses have to be made on the grounds of their significance as a means of interpreting the past and their suitability to the needs, capacities, and interests of the pupils.) Investigations into usage have, however, exerted an influence on the content, the vocabulary, the style, and the format of text-books, and on the use made of material equipment and teaching devices.

¹ Levenson, W. B., *Teaching Through Radio*. New York: Rinehart & Company, Inc., 1945. Woelfel, N., and Tyler, I. K. (ed.), *Radio and the School*. New York: World Book Company. 1945. Stenius, A. C., "Auditory and Visual Education." *Review of Educational Research*, XV, 3, June 1945. Pp. 243-55. Strauss, L. H., and Kidd, J. R., *Look, Listen and Learn*. New York: Association Press. 1948. Corey, S. M., *Audio-Visual Materials of Instruction*. Forty-eighth Yearbook of the National Society for the Study of Education. Part I. Chicago: University of Chicago Press. 1949. Kinney, L., and Dresden, K., *Better Learning Through Current Materials*. California: Stanford University Press. 1949. Svenson, E. V., and Sheats, P. H., "Audio-Visual Aids in Adult Education." *Review of Educational Research*, XX, 3, June 1950. Pp. 216-23.

The earlier studies¹ of social usage took the form of analyses of the items of historical information required for understanding representative newspapers, books, and journals. Their findings stimulated discussion of objectives, examination of topics in existing text-books, and attempts to assess the relative influence of differing emphases in the treatment of historical subjects. These were paralleled in the field of measurement by the development of techniques for attitude testing,² and a beginning was made in the application of such methods to historical research.

Text-book analysis from the point of view of content is leading, for example, to a realisation of the comparative neglect of topics such as education, propaganda, women, arts, race, and social life and the disproportionate emphasis on events of political or military significance. There is a certain body of evidence indicative of the efficacy of deliberate instruction in modifying attitudes, allegiances, and loyalties which goes far to support present-day belief in the efficacy of historical teaching as a means of propaganda.³ At present, however, to judge from the variations of attitudes among pupils subjected to comparable teaching, the influence of the home seems stronger than that of the school.⁴

Along with this went an effort to discover the types of

¹ See: Horn, E., *Possible Defects in the present Content of American History as taught in the Schools*. Sixteenth Yearbook of the National Society for the Study of Education. Part I. Bloomington, Illinois: Public School Publishing Company. 1917. Bassett, B. B., *The Historical Information Essential for the Intelligent Understanding of Civic Problems*. Seventeenth Yearbook of the National Society for the Study of Education. Part I. 1918. Rugg, H. O., et al., *The Social Studies in the Elementary and Secondary School*. Twenty-second Yearbook of the National Society for the Study of Education. Part II. 1923. Pendleton, C., and Washburne, C., "The Fact Basis of a History, Geography and Civics Curriculum." *Journal of Educational Research*, VIII. 1923.

² Cf. Thurstone, L. L., and Chave, E. J., *The Measurement of Attitudes*. Chicago: University of Chicago Press. 1929.

³ Johnson, H., *Teaching of History*. New York: The Macmillan Company. 1940. *The Social Studies in General Education*. New York: D. Appleton-Century-Crofts Inc. 1940. Levi, A. W., *General Education in the Social Studies*. Washington: American Council on Education. 1948.

⁴ Cf. Smith, M. M., "Comparative Social Attitudes." *Journal of Educational Psychology*, 28. 1937. For further evidence on attitudes see also: Murphy, G., et al., *Experimental Social Psychology*. New York: Harper & Brothers. 1937. Albigh, W., *Public Opinion*. London: McGraw-Hill Publishing Company, Ltd. 1939.

learning involved in the acquisition of an adult historical sense; and this, in turn, led to experiments on means of developing skill in finding information (the use of index, catalogue, etc.), in reading with understanding, in utilising information, and in recalling and organising information.¹ These experiments had as their consequence a demand for more highly diagnostic test material.²

While much of the evidence on social usage and on the content of text-books is American in origin, it is interesting to note the progressive lessening in recent English text-books of the amount of mere information as to dates and political personalities, the increasing emphasis on economic and social background, and the enlarged provision for supplementary activities and investigations on the part of the pupils.

Investigations into the vocabulary involved in history teaching have taken three forms:

- (a) word-counts of existing text-books (these led to a realisation of the unnecessary difficulty, the infrequency of repetition, and the unreasonably wide range of the words used in many popular series);
- (b) attempts to determine a basic vocabulary on the lines of similar studies in reading or composition;³
- (c) collections of mistaken conceptions as revealed both by standardised tests and by an analysis of the gradual growth of concepts shown by case-studies of pupils at various ages.⁴

Alongside these vocabulary studies have gone the beginnings of an effort to understand the types of activity which are useful at different stages in developing desirable habits of work, attitudes, or allegiances.

¹ Cf. Simpson, R. G., "The Effect of Specific Training on Ability to read Historical Materials." *Journal of Educational Research*, XX. 1929.

² Tests such as Wrightstone, J. W., *Co-operative Test of Social Studies Abilities*. Iowa: University of Iowa. 1936, attempt, for example, to measure skill in obtaining facts from charts, maps, graphs, etc., and ability in organising facts, interpreting facts, and applying generalisations.

³ For a useful summary see: Horn, E., loc. cit.

⁴ Cf. Sturt, M., *The Psychology of Time*. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1925. Lacey, J. M., *Social Studies Concepts of Children in the First Three Grades*. New York: Teachers' College, Columbia University. 1932. Wesley, E. B., *Teaching the Social Studies*. Boston: D. C. Heath & Company. 1937; and Kelley, T. L., and Krey, A. C., *Tests and Measurements in the Social Sciences*. New York: Charles Scribner's Sons. 1934.

TESTING

Standardised measurement in history began on a somewhat superficial level with surveys as to memory for selected facts—chosen usually on the basis of social utility or frequency of use in certain text-books.¹ There are signs that the recent development of techniques for the factorial analysis of ability as well as for testing values and attitudes will produce important evidence as to the factors associated with the successful development of historical understanding and will provide some means of assessing the personal effects of historical teaching.

(It would be interesting to know in this connection what is the effect on a developing sense of time of the exaggerated emphasis on units and centres of interest which characterises certain schools to-day. A reaffirmation of the importance of time-charts and deliberate instruction with a view to the establishment of concepts may be needed in history as it has been in mathematics as a corrective to over-indulgence in activities and over-employment of equipment.)

Case-studies of pupils who are regarded as successful students of history have not, so far, been so extensive as in the comparable subjects of reading or of oral language. They do, however, indicate a high relationship between success and socio-economic status and general richness of background and experience. There is also evidence of the usefulness of general intellectual ability, satisfactory personal habits of industry, persistence and honesty, good physical health (including

¹ Examples of tests of information are to be found in: Ballard, P. B., *The New Examiner*. London: Hodder & Stoughton Ltd. 1923. Van Wagenen, M. J., *American History Scales*. New York: Teachers' College, Columbia University. 1924. Burt, C., *Northumberland Standardised Tests*. London: University of London Press Ltd. 1925. Carman, H. J., Barrows, T. N., and Wood, B. D., *Columbia Research Bureau American History Test*. New York: World Book Company. 1927. *The Dominion Tests*. Toronto: University of Toronto. 1934. A test of a somewhat more complicated type is that of Wrightstone, loc. cit. Useful bibliographies and reviews of tests are given in: Buros, O. K., *Mental Measurements Yearbook*. New Brunswick: Rutgers University Press. 1938; and Buros, O. K., *The Nineteen-Forty Mental Measurements Yearbook*. Highland Park, New Jersey. 1941. Buros, O. K. (ed.), *The Third Mental Measurements Yearbook*. New Brunswick: Rutgers University Press. 1949. See also the Yearbooks of the National Council for the Social Studies. Philadelphia: McKinley Publishing Company.

vision, hearing, and vitality), freedom from distractions, competent teaching, a suitable collection of text-books, and personal acceptance of responsibility for learning.

The attainment of success in history is not of itself so obviously useful as is that in a subject such as spelling. It does not offer the series of small conquests and the satisfactions of measurable progress in speed or understanding which are associated with increasing mastery in mathematics. The danger of complacent verbalism is probably greater than in the comparable study of geography. The appeal of history is, however, somewhat similar to that of literary appreciation; and incentives for its learning can be found in the developing interest of children in the present condition of the world as well as in the story of the changes that have taken place in relatively recent times. The recognition of the importance of such incentives and the increasing willingness shown by teachers to encourage active co-operation by pupils are both symptomatic of the modifications in teachers' attitudes which have occurred in the last fifty years.

THE FINDINGS OF RESEARCH

1. Training in summarising is followed by a definite improvement in the understanding of printed material.

2. The sense of time develops gradually up to about the age of fourteen. A study of the vocabulary of time is an essential element in its growth. Approximate dates have little or no significance until related to specific ones.

3. The thought processes of very young children are not qualitatively different from those of adults; but with maturity there comes progressive enrichment of meaning and increasing ability to generalise.

4. Concepts involving personal relationships are more difficult to teach than facts about objects.

5. Reliance on incidental and accidental learning for the development of concepts is not justified.

6. Socio-economic status and width of experience correlate highly with range of information and with understanding of concepts. There should, therefore, be systematic attempts to supply a rich background of experience where this is absent.

7. Economy of effort results from preliminary attempts to

determine the range and significance of the concepts held by pupils.

8. Failure to make progress in the use of history text-books is closely related to weakness of comprehension associated with ignorance of the concepts involved.

9. Most reading materials in history are unnecessarily difficult and employ too extensive a range of vocabulary. Pupils' understanding of them is much less adequate and accurate than is realised.

10. Films are useful in the teaching of history as a means of strengthening retention and encouraging voluntary reading. They have also an effect on the development of attitudes.

11. The influence of history teachers upon attitudes is at present less than that of the home or of associates.

RESEARCH NEEDED

Investigations are required on the following subjects:

The relative difficulty of various topics and concepts.

The methods adopted by successful students.

The factors associated with weakness.

Tests for the determination of readiness to proceed to the use of specific types of concepts.

The relative effectiveness of different types of material at different stages.

The relative value and suitable placing of different types of activity.

The extent to which desired attitudes are attained at different stages.

The effect of different methods of instruction and of direct as contrasted with incidental learning.

The optimal order of training in various types of skill.

The relation of reading ability to progress in historical understanding.

The part played by extra-curricular activities in the development of attitudes and achievement.

Analysis of popular text-books with reference to—

(a) range and use of vocabulary;

(b) selection of topics and relative emphasis on topics.

A determination of the minimum essentials for history teaching in Great Britain.

The effect of different types of class-room organisation (grouping by friendship, by ability, etc.).

The contribution of the study of history to personal adjustment and the satisfaction of the primary psychological needs.

The developmental history of competent students—with special reference to family background, attitudes, etc.

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CHAPTER IX

GEOGRAPHY

DEVELOPMENTS in the teaching of geography have followed similar lines to those in the teaching of history. The subject-matter in the two cases is comparable except that the teacher of geography concentrates upon a study of the earth as it is at present and upon man's use of its present resources. So great is the common ground that it is becoming increasingly usual to teach the two subjects together (along with civics) under the title "social studies," and to develop both in connection with projects or centres of interest, such as postal communications, shipping, or sea routes. A certain amount of evidence is accumulating to show that the measurable results obtained from such combined courses are higher than those consequent on series of lessons in which geographical and historical interests are not interwoven.¹

While this method is not new, its increasing influence on the planning of text-books and on the content of curricula may be attributed to the emphasis on what is socially useful and what is actively interesting which followed the acceptance of the results of experimental study of the learning process in the latter part of the nineteenth century.

In geography, as in history, changes have occurred in methods, in text-books, and in testing.² These may be de-

¹ Cf. Seagoe, M. V., "Qualitative Wholes: Class-room Experiments." *Journal of Educational Psychology*, 27. 1936. See also a useful summary of research in the Eighth Yearbook of the National Council for the Social Studies. Philadelphia: McKinley Publishing Company. 1937.

² For a useful summary of the development of testing see: Kelley, T. L., and Krey, A. C., *Tests and Measurements in the Social Sciences*. New York: Charles Scribner's Sons. 1934. Examples of tests of a simple type are given in: Ballard, P. B., *The New Examiner*. London: Hodder & Stoughton Ltd. 1923. Burt, C., *Northumberland Standardised Tests*. London: University of London Press Ltd. 1925. Kelley, T. L., Ruch, G. M., and Terman, L. M., *New Stanford Geography Test*. New York: World Book Company. 1929. *The Dominion Tests*. Toronto: University of Toronto. 1934. More detailed analysis of ability is made by a test such as: *Widefeld-Walther Geography Test*. New York: World Book Company. 1931. This offers material under six headings: study abilities, or-

scribed broadly as a progress from a purely formal and political treatment (with the corollary of passivity and diligent memorising as desirable characteristics of a pupil) to a handling which endeavours to enlist the whole activity of a child in the pursuit of knowledge which is believed to be interesting, meaningful, and obviously worth while on its own account.

In geography, as in history, much learning is by its nature vicarious. Pupils cannot visit other parts of the world and make direct observation on their resources. Visual aids, models, maps, and charts are necessary. Most of these are not essentially new in type, but their use is much more extensive than it was fifty years ago¹; and there has been in recent years a great increase in evidence as to the efficacy of training in activities and the employment of such apparatus as cinematograph films or epidiascopes. There is also much more realisation of the need for training in the use of such aids, and more recognition of the slow stages by which pupils acquire under-

ganisation, map and graph reading, geography vocabulary, geographical relationships, and place geography. Tests of History and Geography are also included in general achievement tests such as: Orleans, J. S., *Public School Achievement Tests*. Bloomington, Illinois: Public School Publishing Company. 1928. Kelley, T. L., *New Stanford Achievement Test*. New York: World Book Company. 1929. Sones, W. W. D., *High School Achievement Test*. New York: World Book Company. 1929. Otis, A. S., and Orleans, J. S., *Standardised Graduation Examination for Elementary Schools*. New York: World Book Company. 1930. Gates, A. I., et al., *The Modern School Achievement Tests*. New York: Teachers' College, Columbia University. 1931. Allen, R. D., et al., *Metropolitan Achievement Tests*. New York: World Book Company. 1933. For useful bibliographies and reviews of tests see: Buros, O. K., *Mental Measurements Yearbook*. New Brunswick: Rutgers University Press. 1938; and Buros, O. K., *The Nineteen-Forty Mental Measurements Yearbook*. Highland Park, New Jersey. 1941. Buros, O. K. (ed.), *The Third Mental Measurements Yearbook*. New Brunswick: Rutgers University Press. 1949.

¹ Cf. Matthews, C. O., *The Grade Placement of Curriculum Materials in the Social Studies*. New York: Teachers' College, Columbia University. 1926. Without direct instruction pupils aged nine to eleven appear to have little ability in the reading of maps, tables, and charts; but they are mature enough to profit by training when it is given. Pictorial graphs, bar graphs, and circle graphs prove easier to read than line graphs; and the reading of graphs and charts of all kinds can be successfully undertaken at an earlier age than their construction. See also: *The Teaching of Geography*. Thirty-second Yearbook of the National Society for the Study of Education. Bloomington, Illinois: Public School Publishing Company. 1933. Horn, E., *Methods of Instruction in the Social Studies*. New York: Charles Scribner's Sons. 1937; and *Geography Teaching Films*. London: British Film Institute. 1938.

standing of technical terms or attain mature awareness of distances and of relative positions in time or space.

Evidence has yet to be obtained as to the effect of modern emphasis on units such as occupations, natural regions, productions, or trade routes. It may be found that concomitant with attention to such centres of interest there is a delay in the growth of a sense of space greater than that which followed upon the older, more formal, treatment of geography in terms of single countries considered in sequence.

Analysis of test-books and courses of study has proceeded on lines similar to that in arithmetic. There have been attempts to determine the range of information which is socially useful.¹ Text-books have been examined from the point of view of their range of content and of the extent of repetition in their vocabulary. Lists have been produced of words which might form the minimum essentials for the study of geography at various stages; and the mistakes of pupils have been collected and arranged according to age-groups in the endeavour to trace the development of ability in geography.²

Analyses have been undertaken of the topics of geography text-books; and some approach has been made to a consideration of the contribution of geography to the promotion of desirable attitudes and allegiances. A certain amount of research has also been done on the factors accompanying success or failure; and some experimental evidence has been obtained as to the usefulness of specific methods under specific circumstances.

Much still remains to be accomplished.

THE FINDINGS OF RESEARCH

1. Films and other visual aids are useful in the teaching of geography as a means of strengthening retention and encouraging voluntary reading.

2. The development of a sense of place is facilitated by training in the recognition of direction, distance, and size of area. Specific standards for comparison in each of these conceptions are essential.

¹ Cf. Thirty-second Yearbook, loc. cit.

² Cf. Horn, E., loc. cit.

3. Fusion of courses in geography and history leads to greater mastery of facts and more insight into inter-relationships.

4. The ability to understand geographical concepts is less adequate than is generally assumed.

5. Without direct instruction pupils aged from nine to eleven have little ability in the reading of maps, tables, and charts; but they are mature enough to profit by training when it is given.

6. Reliance on incidental learning in the interpretation of graphs or the reading of maps is not justified.

7. Pictorial graphs, bar graphs, and circle graphs are easier to read than line graphs.

8. The interpretation of graphs is easier than their construction.

RESEARCH NEEDED

Research is needed on the following topics:

Studies of the relative difficulty and approximate grade-placement of various topics.

Study of the methods adopted by successful students.

Case-studies directed towards investigation into the factors associated with weakness in geography.

The development of tests for the determination of readiness to proceed to specific types of learning.

The relative attractiveness and effectiveness of various types of text-book format.

The contribution of films, film-strips, and other teaching aids to interest and to retention.

The effect upon learning of differing types of teacher-pupil relationships and differing types of class-room grouping.

The developmental history of students at various levels of competence.

The contribution of the study of geography to personal adjustment and mental health.

The relative influence of individual study, projects, school excursions, etc., upon enthusiastic study.

The contribution of geography to international understanding and good citizenship.

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CHAPTER X

THE SOCIALISING OF THE CURRICULUM

WHAT then is the conclusion of the whole matter?

Many investigations have been completed in the last fifty years. Much has been accomplished in each separate subject-field. Much still remains to be accomplished. It seems reasonable to enquire whether any generalisations can be drawn as to the effect of so much patient labour. Changes have admittedly occurred in many directions. Perhaps the most illuminating summary in the light of present needs can be made by considering what have been the main modifications in the content of the curriculum, and what have been the chief alterations in the measurement of the products of education. Brief notes on these topics are therefore offered in this chapter and in Chapter XI.

THE CONTENT OF THE CURRICULUM

Superficially there has been little change in the content of the curriculum. Schools in the first decade of the century offered instruction in English, arithmetic, geography, history, nature study. They included in their time-tables writing, drawing, singing, drill, handwork, and sewing. In the sixth decade these subjects are still represented. Their titles have been somewhat modified, but the ground covered is recognisably comparable. At this point, however, the similarity ceases. To a greater or lesser extent in all schools of the state system where the staff consists of trained teachers, the direction of emphasis has shifted. The same range of subjects is included; but the subjects are treated in a modified manner and the expectations and wishes of the school community are turned towards different ends.

ENGLISH

In connection with the teaching of English, these changes are very clearly illustrated. Fifty years ago the emphasis was

chiefly upon the formal study of grammar, the oral reading of a small number of books, and the writing of a limited number of carefully rehearsed essays. Thirty years ago—at the opening of the third decade—attention was turning towards the sociological background of learning. Teachers were setting themselves to study the activities of adults in the communities which their pupils might later be expected to join. Enquiries were undertaken as to the social uses of the curriculum. Lists were made of words which pupils were likely to be required to spell, forms of sentence structure which they might wish to be able to use, and books which it was desirable that they should be able to read.

By the beginning of the fourth decade, it was realised in most places that silent reading was an activity different in kind from oral reading as well as more frequently utilised; and deliberate attempts were made to foster skill in comprehension. There was much scepticism as to the efficacy of formal grammar as an aid to composition, and the energies of teachers were turned towards winning the co-operation of their pupils in language activities comparable to those in use outside the schools. This encouragement to purposeful action found its justification in increased skill in expression both oral and written.

Participation in projects was organised with this end in view, and text-books were favoured which combined opportunities for practice in silent reading with suggestions for the development of centres of interest or the stimulation of lines of enquiry. Attention turned towards the dramatising of subject-matter. Miming, puppetry, and the contributory services of music, art, handwork, and sewing were all moulded to the service of the active conquest of the desired skills in what was formerly thought of as "English."

This type of training is now very widely practised, and there is evidence that it has resulted in improved standards of performance in speech, in reading, and in writing.

In the last few years it has, however, begun to be accompanied by a further change of emphasis based upon the recognition that the whole personal development of the pupil matters more than his increase in skill in a subject-field and that failure and incompetence have a profoundly damaging effect upon mental health. Attention is therefore turning to

the socialising influence of the curriculum and the contribution which reading and self-expression may make to the harmonious development of each pupil's personality.

ELEMENTARY MATHEMATICS

Similar stages can be traced in the teaching of elementary mathematics. Fifty years ago arithmetic lessons were formal both in content and in method. By the second decade of the century questions were being asked as to the social uses of the subject. Much "dead wood" was discarded, and the treatment of the minimum essentials which remained was widened to include provision for practical activities, and for the study of the meaning of geometrical concepts, of fractions, and of graphs. The subject was then more than a mere training in computation. It became social in its aims—encouraging observation and the collection of information from the workaday adult community and from the homes of the pupils.

Throughout the third decade this movement towards greater civic usefulness became stronger, and it lent its support to the purposeful activities encouraged by experimentation in other subjects. By the fourth decade its effects were widespread, and greater interest in the remedial treatment of problem pupils was beginning to create awareness of the personal consequences of success and failure. The last few years have seen an increase in this awareness and a concomitant determination to ensure success by wise adaptation to individual differences as well as by the use of adequately graded text-books of self-instructive material.

OTHER SUBJECTS

Similar stages may be noted in the methods adopted in other subjects. Music, crafts, art, writing, and needlework (with the social studies and physical education) have all passed from an emphasis on formalism to a more functional adaptation to life as it is lived in the community outside the schools. Teaching methods have progressed from the organising of drill on isolated segments of subject-matter to an encouragement of insight into the meaning and the use of each activity as a whole. They have also been profoundly influenced by

current evidence on the reality and the extent of individual differences.

Perhaps the major contribution of the last fifty years may indeed be said to be this extending consciousness of the need for the adjustment of schooling to the varieties in rate and type of learning observable among pupils. Many books have been written in description of experimental work in Dalton, in Winnetka, in Brussels, Glasgow, and London. Full discussion of their findings is unnecessary here; but it may be noted that (as in the case of English and mathematics) two attitudes towards such experimentation have developed among teachers who are enthusiastic in its support. There is the older point of view which lays stress on the superior efficacy of individualised work as a means of learning the essentials; and there is the more recent attitude which stresses the socialising influences of individualised activities and emphasises the opportunities they provide for the development of greater social and emotional maturity.

Associated with this latter viewpoint is the increasing awareness of the value of study of the whole personality, which finds its simplest expression in willingness to undertake case-studies and to keep cumulative records of the progress of each pupil.

In these records space is now usually provided for the rating of attitudes and personal attributes. Their inclusion implies a recognition of the importance of personal development, though it carries with it no claim that the assessment of personality can be as exact as the measurement of other educational products. It is indeed, admittedly, as yet of the somewhat indeterminate type which can better be described as appraisal or evaluation. Its appearance on a record-card is, however, both significant and indicative of the fact that, for many teachers, the socialising influence of the curriculum is coming to be counted its major contribution to educational progress.

CHAPTER XI

THE MEASUREMENT OF EDUCATIONAL PRODUCTS

EDUCATIONAL measurement is not, of course, new. It is, in essence, part of the process of learning. The growing pupil reacts in some fashion to the teaching he receives and the teacher is inevitably more or less aware of his response. Some judgment is formed upon it; and such adjudication is the prototype of all measuring.

Testing, however, differs in kind. More than forty years ago it was very completely bound up with the teaching situation; and assessment of a pupil's self-expression was subjective and supported only by *a priori* opinion.

Some of the examining of today is still of this type. It relates to activities which are quite appropriate to the process of learning, but without any special significance beyond the temporary circumstances of a single class-room. Notable among such activities is the long-sustained response exemplified in essay-type answers or the solving of involved problems. The assessment of such responses is essentially personal and remains at the level of the theoretical appraisal which was formerly the only type of examining practised. It is not nowadays suggested that such sorts of occupation should never be engaged in by pupils; but the claim is made that their nature and their aims should be distinguished from those of the testing whose emphasis is upon consistent and reliable measurement rather than upon the generalised activities more suited to the acquisition of skill. The history of testing is the history of the clarifying of this distinction. It may be reviewed briefly in relation to some of the main subjects of the basic curriculum.

READING

In the case of reading, assessment in the class-room until the end of the first decade of this century was confined to comments upon the effectiveness of pronunciation and enunciation.

On such matters each teacher had his own opinion, and there was then no way of securing samples of oral reading from other schools to serve as a check upon the subjectivity of his judgment.

When measurement of silent reading was first attempted it inherited the superficiality of this method. Rate and accuracy were still the only aspects considered, and it was not until the second decade that attempts were made to secure greater objectivity of judgment. The principle of age-performance then began to be applied both to the determination of the suitability of the passages selected and to the discovery of a reasonable level of performance. This meant that before testing pupils with a test, experimenters tested the test on pupils of comparable status. Only after such experimental verification did they venture to use new test material. Acceptance of the desirability of this means of avoiding personal prejudice marks the dividing-line between old-type and new-type examining. New-type examining has in the last fifty years increased in complexity and discriminative power; but its essential nature was established when the principle of age-performance was clearly formulated.

Authors of the first objective tests of reading asked two questions:

- (1) How many words can you read in a given time?
- (2) How many ideas can you report after you have finished reading?

Difficulties in the consistent marking of the second question led to the next step. It was realised that greater uniformity could be secured by asking more definite questions. These were, however, at first of an uncontrolled type with no specific limitation of the nature of the answer expected. Such questions are typical of the latter part of the second decade.

The third decade saw much greater clarity of conception. It was realised that uncontrolled questions led to wide variations in length and type of response, as well as to a wasting of time on irrelevant activities, such as writing. The next step, therefore, was to limit replies to two or three words or to invite underlining or crossing out of the correct response out of four or five possibilities.

The next stage followed upon a fuller study of the reading process itself. Analysis was attempted into various subsidiary

activities, such as the recognition of words, the observation of details, the making of inferences, the power to exercise discriminative judgment, and the like; and test results became increasingly useful as a means not merely of measurement but of guidance to the specific difficulties of each pupil.

The fourth decade saw further perfecting of such testing, the popularising of the title "diagnostic" in connection with the discovery of the degree of reading-readiness, and a turning of attention to the interests and attitudes of children as distinct from their performance in tests of sheer attainment. Measurement of attitude towards schooling began to be included as an essential part of the process of assessment; and studies of the reading interests of pupils at different ages drew attention to the importance of social relationships and emotional states.

ARITHMETIC

Similar stages can be traced in the development of testing in arithmetic. Old-type examinations contained much irrelevant transcribing of numbers. They consisted of elaborate and involved examples with a large variety of computations at many different levels. Their marking was unreliable. Examiners differed in the emphasis they put upon correctness at different stages of the lengthy calculations involved. New-type examinations can cover the same ground in more clear-cut fashion. They consist of many short examples arranged in an order of difficulty determined after experimentation. The content of these exercises is, of course, influenced by the sociological criticism of the second decade. Selection of the vocabulary and the processes which are to be included is made in the light of evidence as to their social uses and their relevance to the out-of-school requirements of children or of adults. Much "lumber" has been discarded and many unnecessary technical terms no longer appear.

With the aid of such material a more reliable estimate can be formed of the exact condition of readiness of a pupil and his preparedness to pass to a new stage.

WRITTEN EXPRESSION

In composition also progress has been made from considerable indefiniteness and confusion of types to a condition of

much greater clarity. In the first two decades when mathematical testing consisted of judgments upon a few involved calculations, the measurement of skill in written expression took the form of assessments of a similarly small number of "essays" or compositions. In these compositions pupils were expected to reveal their ability to select ideas, to arrange them in order, to understand the meaning of words, to use them correctly, to write them legibly, and to spell them in an acceptable fashion. Marking of these differing activities was attempted in quite uncontrolled form; and no account was taken of the irrelevancies introduced by variations in the amount or the type of the material produced. It is not a matter for surprise that such efforts proved unreliable indices of pupils' skill as well as a contributory cause of much irregularity and unreliability of assessment.

Present-day tests of written expression are less ambitious but more clearly defined. They attempt measurement of each skill in isolation, and they involve assessment of responses from which, in many respects, the irrelevant activities have been removed.

Uncontrolled questions in reading, long examples in mathematics, and essay-type responses in English are characteristic of the subjective and uncritical examining of four decades ago. They are suitable enough as learning activities within the social situations of one class-room. Their appearance in tests which are to carry weight beyond the confines of one school leads to unreliability of marking and subjectivity of educational standards. For this reason their inclusion in such tests is increasingly deprecated.

THE GIVING OF TESTS

The administration of tests, like the construction of examinations, at present takes two forms. There is the older approach in which the test is essentially part of the teaching situation and its giving is haphazard and almost infinitely varied in method. Teachers when acting as examiners in the fashion of forty years ago are sometimes silent, sometimes talkative, sometimes stern, sometimes casual, and the effect of such differences of presentation is as little regarded by them as is the attitude of their pupils to the test.

Teachers who have accepted the findings of research recognise, on the contrary, that in the giving of an objective test their responsibility is to contribute to the impartiality of the assessment by following with perfect exactness the directions formulated in the course of its construction. They are aware that to introduce modifications is to change a standardised test into an unstandardised one, and with that to sacrifice its impartiality and the possibility it offers of making unprejudiced comparisons between educational attainment in one class-room and in another. They are also conscious of the increase in technical skill and in diagnostic success which has been brought within their grasp by modern developments in the science of testing and the more accurate interpretation of results rendered possible by its aid.

Such changes in attitude are in themselves a major part of the reward of the research workers of the last fifty years, who have laboured to secure results which from day to day appeared small, but which on retrospect give cause for renewed effort and hope for the future.

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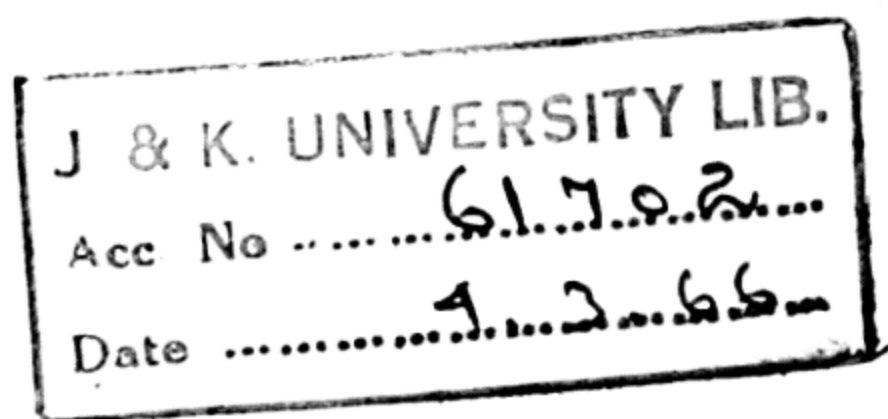
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